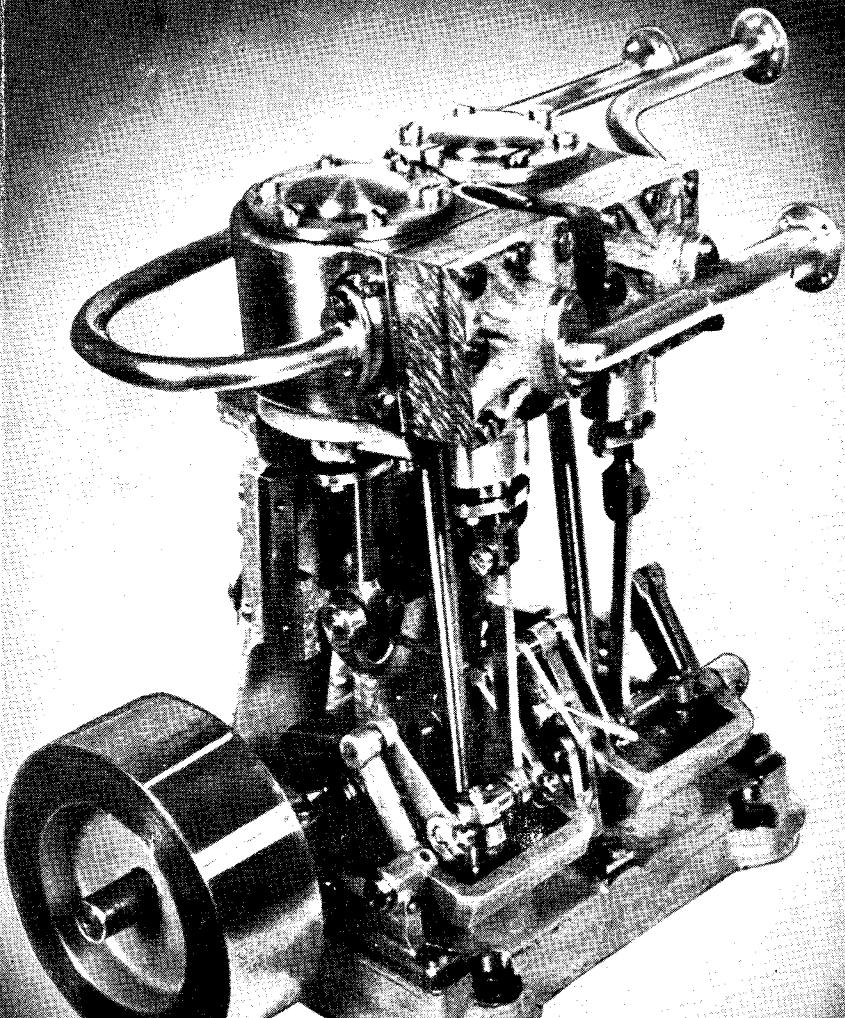
THE MODEL ENGINEER



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The MODEL ENGINEER

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27TH MAY 1948 VOL. 98 NO. 2453

SMOKE RINGS

Our Cover Picture

● THE PHOTOGRAPH reproduced this week shows a twin-cylinder $\frac{5}{8}$ in. bore by $\frac{5}{8}$ in. stroke marine engine, with a rather unusual valve gear, the work of Mr. G. H. Walter. The two eccentrics on the crankshaft are connected to a tube mounted on a spindle which swings on two links. The fulcrum points of these two links are at the top of a "U"-shaped weigh-bar, which itself is pivoted between bearings. In the position shown in the photograph, the arc of oscillation of the swing links will be out and upwards, carrying the valve spindle with it. When the weigh-bar is swung outwards the arc of oscillation is reversed and with it the valve spindle. Every part except spindles and crankshaft are castings, and patterns and machining were effected on a home-made lathe.—P.D.

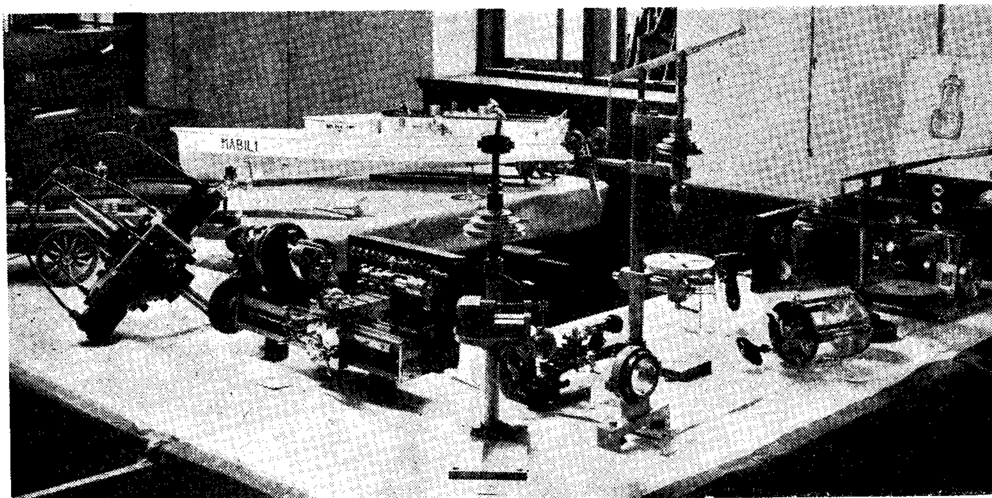
Do it Yourself!

● WE READ recently in a London newspaper of a reader who dropped his camera causing the shutter to jam. After leaving it at the local photographers for two months, he was told that they were "too busy" and had done nothing with it. At a second shop he was informed that repair costs were too high for the camera to be worth repairing. Next, a firm of well-known chemists estimated £8 10s. 0d. "including fitting new bellows," which it did not need. Finally, in desperation, he tackled the job himself with a screwdriver and a pin, never having seen inside a camera in his life. Within twenty minutes he had pushed a spring back into position and reassembled the camera, it worked fine. We have often heard of similar cases where the man of the house has done some small domestic repair and so earned the gratitude of the other, and "better," half of the household, and often, too, we have heard that from such small beginnings, model engineering has become a man's chief hobby. There must be a hundred and one repair jobs to be tackled these days, so why not do them yourself, save money, learn to use hand tools, and enjoy the satisfaction and mental relaxation of physical achievement. From such beginnings the desire to use larger tools, such as lathes and drilling machines grows and, who knows, you may some day be the proud builder of a fascinating working model or the creator of some delicate piece of engineering craftsmanship.—W.H.E.

A South African Exhibition

● A SUCCESSFUL exhibition of models was held at the Natal Technical College, Durban, S.A. This was the first show of its kind to be held in Durban since 1937, due to the war. The local model engineering, yacht, aircraft and racing car clubs co-operated in the exhibition, there being about 150 exhibits shown by 75 individual exhibitors, in sections devoted respectively to stationary engines, locomotives, prototype sailing and power boats, speedboats, racing yachts, aircraft, cars and petrol engines, and workshop equipment. An outstanding attraction was the "O" gauge electric railway system with some electric locomotives taking current from overhead wires, as is done on the electrified Natal main line of the South African Railways. The trophy presented by Mr. R. B. Smith, chairman of the Durban Society of Model Engineers, for the best mechanical model on show was awarded to Mr. L. Ellison for his working scale model of the cruiser H.M.S. *Southampton*. Public attendance was not quite so large as the organisers had hoped, but much interest was aroused, and a direct consequence of the exhibition has been the formation of a liaison body between the four clubs concerned. It is hoped that this body will be able to obtain outdoor facilities for model sports in Durban: space is sought for a model car-racing track, U-control flying, and a permanent track for "live steamers." Altogether, Durban modellers are very active in all branches, and look forward to great things in the future.

—W.H.E.



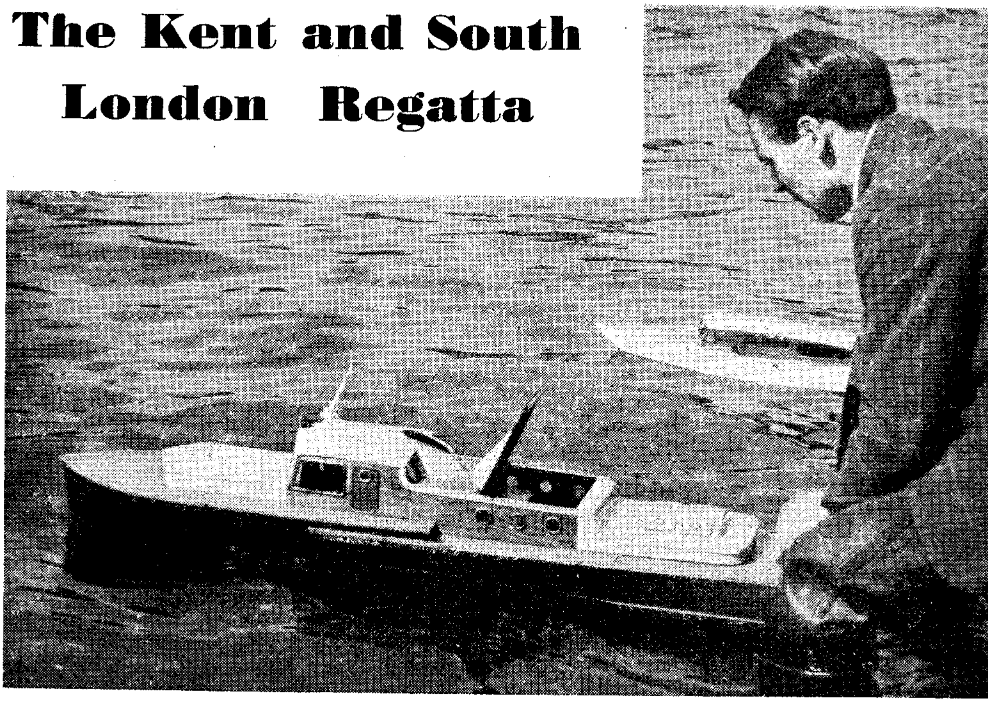
Some of the models and workshop equipment on show at the model engineering exhibition held in Durban, South Africa

A New Club Formed

● THE SUCCESSFUL inclusion of a Model and Arts and Crafts Section in last year's Flower Show had the effect of bringing about a meeting of model engineers, and the result was the formation of the E.E.C. and Napier Model Engineers Club which held its inaugural meeting on March 1st, 1948. The club is very fortunate in having the full backing and interest of the works management, who have been generous in giving permission to use the apprentices' School Workshop and Lecture Room for meetings one night per week. Workshop meetings are held each Monday evening from 6 p.m. to 9.30 p.m. and are well attended. The workshop, needless to add, presents a hive of industry, while the lecture room provides facilities for designing, drawing and discussion. Amongst other things, members are at present busily engaged on the construction of small petrol and diesel engines, $2\frac{1}{2}$-in. and $3\frac{1}{2}$-in. gauge locomotives, racing cars, and a high-speed experimental steam engine. Present efforts are being aimed at producing a more successful model section at the next works Flower Show, which is to be held on July 17th, when it is hoped to have a $3\frac{1}{2}$-in. gauge locomotive doing some passenger hauling. The club's first outing was provided by the kindness of the Vulcan Foundry Co. Ltd. (locomotive works), who arranged for a small party to visit their works. Two very full hours were spent inspecting the machine, erection and boiler shops. A notable point in connection with these works is the fact that they were founded by the great engineer, George Stephenson. The club has already forty members and is very fortunate in having for one of them Mr. W. E. Briggs, who is an associate of "L.B.S.C." and the "inventor" of the "Briggs" fire-hole ring. It is hoped that in the near future further facilities might be provided to encourage and embrace all branches of model making and arts and crafts, other than model engineering. It is also aimed to have lectures once a month and to arrange further visits to local engineering establishments. The Hon. Secretary is J. R. Thorougood, 5, Canterbury Avenue, Waterloo, Liverpool, 22.

—J.N.M.

The Kent and South London Regatta



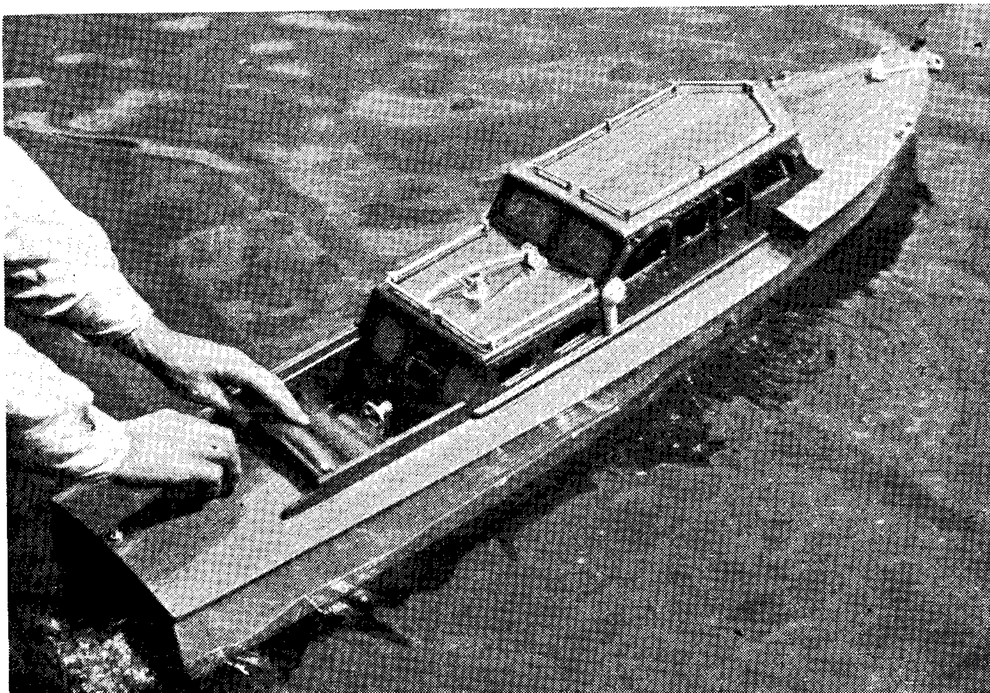
Mr. Whiting, junr. (Orpington) with his steam-driven cabin cruiser

THE first open regatta of the season was held at Brockwell Park, South-East London, on Sunday, April 25th. This was a joint effort by the Kent and South London Clubs. The event turned out very successfully; several new boats were present, including hydroplanes fitted with surface propellers. The circular course events were held during the morning and the free-running events after lunch; this was due to local regulations regarding the noise of racing boats.

Mr. G. Lines (Orpington) starting "Blitz III"

The Jutton Bros. (Guildford) starting "Vesta"

Thus the first event was a 300-yd. race for "B" and "C" Class hydroplanes. Speeds were not high, but nevertheless some quite good performances were set up. Mr. Cruickshank (Victoria), with an "Atom Minor" 6-c.c. two-stroke engine, fitted to *Defiant II*, put up a very fast run, but due to an error, this was not timed, and took this over, Mr. Lines had difficulty in getting the boat away, and after several attempts, the engine revs. increased enormously while the propeller stood still, the $\frac{1}{4}$-in. diam. propeller shaft having sheared. Mr. Walker (Malden), with *Gilda* took second place in this event, putting up two very good runs.



Mr. Griffin's petrol-driven cabin cruiser "Victoria" (S. London), an outstanding example of fine detail work and finish

further attempts were not so successful. Another highly interesting boat in this race was Mr. Jutton's (Guildford) flash steamer *Vesta II*, now fitted with a surface propeller, which showed great promise, although signs of wet steam were evident. The best performance was put up by Mr. Ridley (South London), with a new petrol-engine driven boat.

RESULT :

1st - Mr. Ridley (South London) - 23.2 sec., 26.4 m.p.h.
2nd - Mr. Cluse (Orpington) - 30.2 sec., 20.4 m.p.h.

There were not quite so many boats in the "A" Class race of 500 yd., but there were several interesting new craft. Mr. Miles (Malden), with a new hull of unorthodox design, put up the best speed; the behaviour of this boat on the water was impressive, and it ran very smoothly and steadily. When Mr. G. Lines (Orpington), came on with *Blitz III* (successor to *Blitz II*), some fireworks were expected, as he had fitted an outsize in surface propellers—nearly 6 in. in diameter! Although the engine

RESULT :

1st - Mr. Miles (Malden) - - 33 m.p.h.
2nd - Mr. Walker (Malden) - 31.94 m.p.h.

After the lunch interval, the regatta was resumed with the nomination race for free-running craft. A very good turn-out of boats was seen, including two from Swindon. All types of craft were represented, about 20 boats taking part.

RESULT :

1st - Mr. Phillips (South London), error .05 sec.
2nd - Mr. Vanner (Victoria) - *Leda III*, error 1.5 sec.

Immediately following the nomination race came the steering competition, over a particularly long and tricky course. Consequently many boats failed to score. The winner of this competition, making up for his lack of success in the "A" Class event, was Mr. G. Lines (Orpington), with his straight-running boat, *Blitz I*.

A Magnetic Clock Escapement

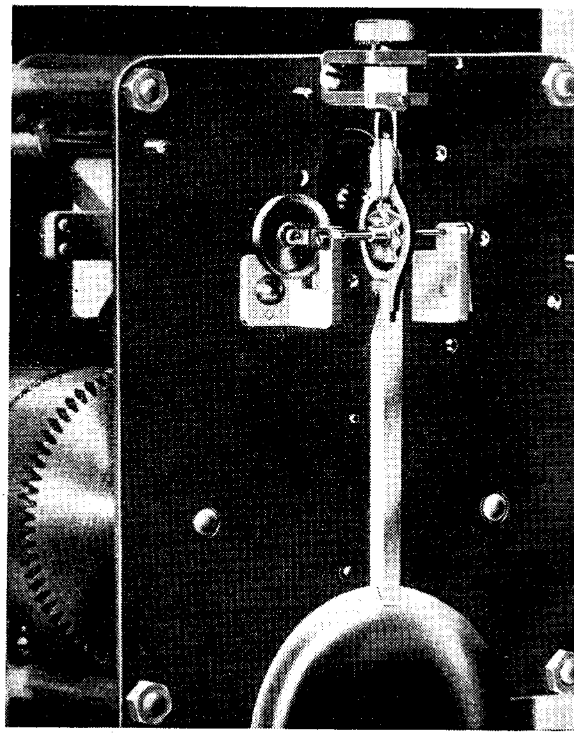
by Edgar T. Westbury

THE art of the clockmaker is so ancient, and has reached such a mature stability, that it might well be thought that there is little, if any, room for improvement in the design of the mechanically-driven type of clock. Since the invention of the gravity escapement, there have been few important innovations in clock design, except in respect of clocks either driven or maintained by methods other than simple "clockwork."

The fact that there is nothing yet devised by the brain, or fashioned by the hand of man, which cannot be improved upon, however, is demonstrated very forcibly by an invention which, on the face of it, appears to lead the way to a complete revolution in mechanical clock design.

As every practical horologist will probably agree, the escapement, while being the most vital and essential feature in any clock, is at the same time, potentially at least, its most prolific source of trouble and error. This is proved by the continual efforts and brilliant ingenuity which have been devoted to the improvement of the escapement, by innumerable inventors, ever since clocks were first introduced; and, also, by the gradual improvement in the accuracy of timekeeping which has resulted thereby. Although the final accuracy of a clock is dependent upon the period of vibration of the pendulum or balance, the problems in the design of these components are relatively simple, compared with those in the design of an escapement which, while supplying the impulse necessary to maintain their motion, will interfere as little as possible with their free and natural period.

In a new escapement invented by Mr. C. F. Clifford, of Bath, magnetism is utilised to lock the clock mechanism in synchronism with the pendulum, without any mechanical friction, or even contact, between the escapement and the vibrating component. One does not need to be a clockmaker to realise that this removes at one sweep a hitherto inherent enemy of all escapements—destructive wear, which although capable of being slowed down by good workmanship, design and correct choice of materials, is inevitable and inexorable in all escapements previously used. Nor is this all; the magnetic escapement, so far from interfering with the natural period of the pendulum, can be designed to produce an impulse which is harmonic in character, and the motion of the gear train, instead of being intermittent, can be even and continuous, thereby reducing wear and tear of the driving gear train.



A modified form of the escapement in which the magnet is carried on the pendulum-rod and the wave-form armature on the revolving shaft

Various different versions of the magnetic escapement have been produced, but the example shown in the drawing reproduced herewith is easy to understand and will, therefore, serve to explain the general principle. The pendulum itself is of fairly normal design, and suspended in the ordinary way, but at some convenient point in the rod, a ring of brass or non-magnetic material (B) is introduced, so as to surround concentrically a wheel (A) carried on the final shaft of the clock gear train, the axis of which is in alignment with the plane of the pendulum swing. In other words, the ring passes axially over the wheel, to an extent depending upon the angle of arc through which the pendulum swings.

The wheel on the shaft is made of magnet steel, and consists of an even number of arms or spokes, each magnetised to form a bar magnet,

the polarities of adjacent spokes being opposed, to produce alternate N and S poles. Inside the ring on the pendulum-rod is fixed an annular strip of soft iron or other permeable magnetic material (C), which is bent edgewise to produce

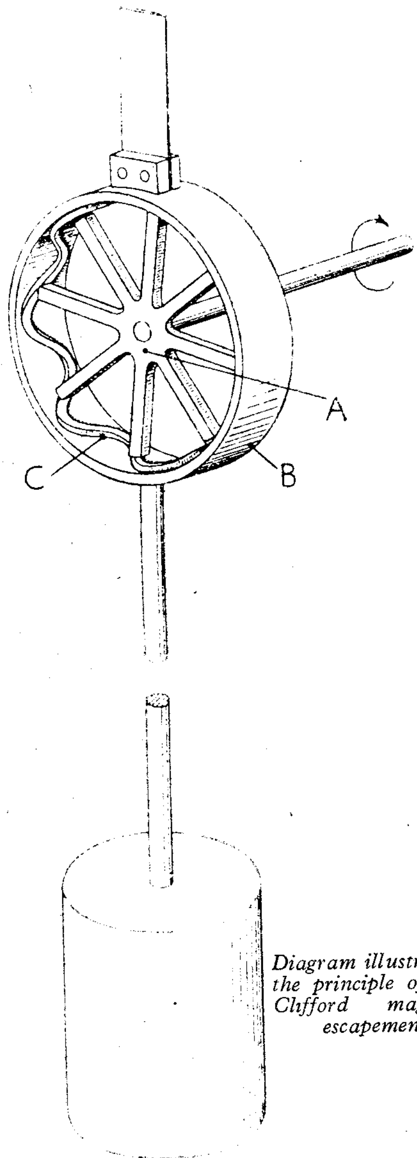
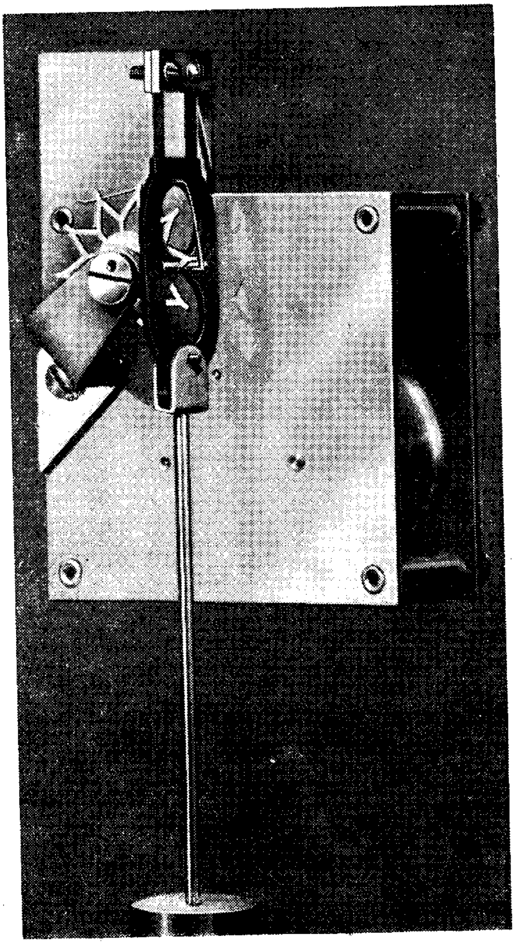


Diagram illustrating the principle of the Clifford magnetic escapement

a number of undulations corresponding to the number of magnet poles in the wheel. In its most efficient form, these undulations are of true *sine* wave form, and of a " wavelength " equal to the distance between the magnet poles.

The inner diameter of the annulus is such that it fits over the arms of the wheel with the minimum working air gap, and the position of the pendulum system is carefully adjusted so that the air gap is equal all round, except for such error as cannot be avoided, due to the ring moving in an arc instead of a straight line. In practice, the arc of swing can be made sufficiently small to render the effect of this error negligible.

Owing to the magnetic attraction between the arms of the wheel and the annular ring, there will be a tendency for the poles of the magnet to " cling " as closely as possible to the track of the ring, although not in actual contact with it. This force is sufficiently powerful to resist the torque exerted on the wheel by the driving gear train, and if the pendulum is at rest, the latter will stop, with the arms of the wheel in a position midway between the peaks of the *sine* waves.



Another variation of the escapement, with the armature in the form of a star wheel

If now the pendulum is set swinging, the arms of the wheel, impelled by the driving train, will still tend to " cling " to the ring, and will, therefore, follow the *sine* wave, " escaping "

(*Continued on page* 555)

*Building a $3\frac{5}{8}$-in. Centre Lathe

by E. W. Brennand

A VIEW of the tailstock is shown in Photo No. 6, and it is of the set-over pattern. It is not intended that any use shall be made of this feature for taper turning (a very doubtful asset) but it was arranged in this manner to give quick and easy alignment with the headstock centre. Once this is obtained, the tailstock setting is left undisturbed.

A tailstock may appear at first sight to be a comparatively unimportant feature of a lathe, and it might seem that, provided it fulfils its function of supporting work that requires turning between centres, then that is all that matters. There is much more in it than this, and the following points should be noted. The barrel should be of large diameter to provide stiffness when it is fully extended, and when in that position sufficient of the barrel should remain in its housing, so that it is adequately supported. The fit of the barrel and housing must be extremely good so that the former is not forced out of centre when the locking device is operated. The barrel must be correctly aligned with the ways of the bed so that work is turned parallel when the tailstock centre is in the fully extended position and also when fully withdrawn. The centre height must correspond closely with the headstock centre height in all positions of the barrel, and while a slight error here does not affect the parallelism of turned work to any measurable extent, it does act adversely when long holes are to be drilled by a drill held in the tailstock. As a matter of convenience, it is better to have a lever lock for clamping the tailstock to the lathe bed rather than to have a spanner-operated nut.

Without wishing to enter into any controversy (since there is a weight of opinion against him) the writer prefers a tailstock with an internal screw feed to the barrel, to that type where the barrel is screwed externally and operated by a disc or wheel fitted over it. The pattern for which preference has been expressed is more pleasant and less fatiguing to use when drilling has to be done, and a large amount of this kind of work seems to fall on the average model engineer's lathe, if only as a roughing-out operation preliminary to actual boring. The internal screw can also be arranged to eject centres and drill chuck shanks when the barrel is screwed right back, and this is a much nicer proceeding than hammering them out with a bar passed through the barrel or twisting them out with a spanner or tommy-bar.

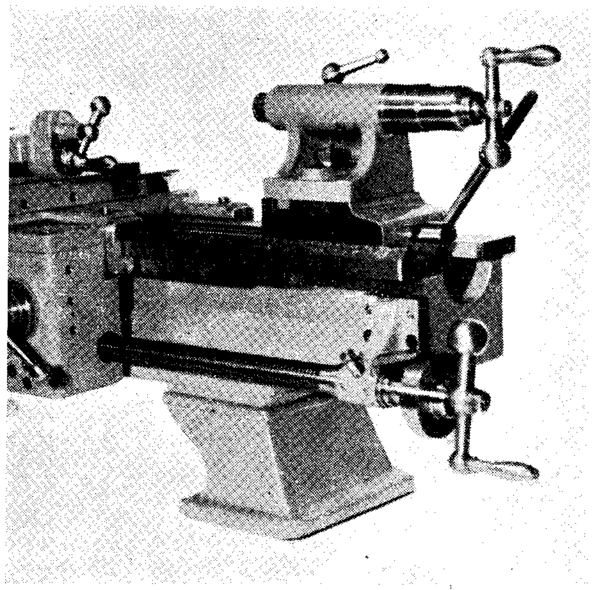


Photo No. 6. The tailstock

To secure the required accuracy, very careful machining of the casting was required. These castings were, by the way of Meehanite, being obtained to patterns made at the same time as those for the bed. The upper part of the tailstock was dealt with first and the first operation was boring out the barrel housing. This was done with the casting mounted on the lathe saddle, using a boring-bar between centres, a cored hole having been arranged for when the pattern was made. After boring, the hole was lapped to size and parallelism, and to a high degree of finish in order to minimise wear on the barrel. The latter was lapped to a tight sliding fit in the hole.

The casting was then secured, base uppermost, to the table of the miller, in such a position that the tenon was machined at right-angles to the barrel housing, the barrel being pushed part way into the hole and checked by dial indicator to the miller table movements to secure the desired result. The remainder of the base was milled flat and parallel with the centre line of the hole, correct setting of the casting for this being obtained by dial indicator readings on the barrel.

**Continued from page 508, " M.E.," May 13, 1948.*

The base of the tailstock (that part which seats on the lathe bed) was next dealt with and the back vertical surface was milled up and scraped to act as a reference face. Then, with this surface set parallel (by indicator) to the stroke of the machine, the base was planed to fit the V-way and flat way of the lathe bed. Turning the casting over and using the stock of a square against the reference face, the job was clamped so that the blade of the square was parallel to the machine stroke and in this position the slot for the tenon of the upper portion, and the remainder of the top surface, were planed up. A little thought will show that the line of the tailstock barrel is then parallel with the V in the base, and consequently in line with the lathe bed when the two portions are assembled. The methods described are a repetition of those used, in effect, when planing up the saddle. The small errors which naturally were to be expected, were put right by scraping the surfaces concerned.

It remained to secure the same centre height for the tailstock as that of the headstock, and in planning operations it had been decided to leave this until the rest of the lathe was finished. With this in mind the tailstock base was left about 1/64 in. thicker than its final dimension, making the tailstock centre height slightly high compared with the headstock. The simplest way of ascertaining the amount to be removed to obtain the exact final measurement will be described a little later on.

The Rack

This item has been left until last, as, in fact, it was the last main item of the lathe to be made, that is, with the lathe in its original form before the new headstock was fitted. It was left to the end because it provided the biggest problem of all in the making of the lathe. Matters would have been relatively easy if the writer had been content to make the rack in several pieces butted together, but this solution was rejected. A number of possible solutions to the problem of how to cut the rack in one length with the available equipment were thought over and condemned in turn, until finally the writer hit on a method by which he could cut it in the Exe lathe. The method necessitated the making of a special fixture, involving a good deal of work, so much, in fact, that the time spent in preparation was many times that which was required to do the actual cutting of the rack. To describe the method fully enough to make it readily understandable would take considerable space, and as the writer feels that a description would be rather beyond the scope of this article, he will merely say that the job was successfully done and the rack is satisfactory in every way.

Aligning the Lathe

Having got the lathe into working condition, it remained to align the various units so that accurate work could be achieved. The headstock was the first to be dealt with. The tenon of this sits in a slot in that part of the bed on which the headstock is mounted, there being plenty of clearance allowed between the sides of the slot and the tenon. Four adjusting screws (two in front, two in rear) pass through the bed and engage with the tenon—a pair at each end so that the headstock can be slewed round when the bolts holding it down on the bed are slackened. By turning a short length of bar in the chuck or preferably a collet, it was merely a matter of trial and error in manipulating the adjusting screws so that dead parallel turning was obtained.

Having secured parallelism in a test piece some 3 in. long a dial indicator was held in the slide-rest and traversed over the top of the piece in a lengthwise direction. The difference in the indicator reading at each end gave the error in the vertical alignment of the spindle. This error was corrected by scraping the headstock base—a tedious process, since repeated tests with the indicator had to be made as work progressed, the headstock having to be repeatedly removed from and replaced on the bed.

The necessary correction having been made, the setting of the cross-slide was checked. A button with a dead flat end was secured to the faceplate at a radius from the centre of just under half the total movement of the cross-slide. The saddle being locked to the bed, the dial indicator was held in the top-slide and brought to register with the button, with the faceplate in such a position that the button was at the front of the lathe. The spindle was then turned through 180 deg. and the cross-slide fed forward until the indicator again registered with the button. The difference in the readings showed how much the cross-slide movement was out of true relative to the centre line of the lathe spindle. The writer was lucky—the error being only 0.0005 in 4 in., and in the right direction, i.e., the error was such that the lathe faced concave. Convex facing is not permissible. This small amount of error might have been disregarded, but as it was desired to have things as near perfect as possible, the V-ways on the saddle which guided the cross-slide were scraped until the error was to all intents and purposes reduced to nil, as shown earlier in this article.

There is a published limit which concerns the parallelism of the top-slide with the bed in the horizontal plane, so this was checked with the dial indicator. The error was 0.0005 in. in 5 in., and as this was within the limits allowable, no correction was attempted, particularly as a small error here is of little practical importance.

In the case of the tailstock the barrel was fully extended, and the dial indicator (held in the top-slide) was traversed along the front of it by racking the saddle along the bed. The error shown was corrected by scraping the tailstock tenon. This done, the indicator was traversed along the top of the barrel and the error corrected by scraping the top face of the tailstock base. After this, all that remained was to bring the tailstock down to headstock centre height. This was accomplished by simple means. A short bar, held in the chuck, was turned to the exact diameter of the tailstock barrel. The latter was then brought up to the bar, and with the dial indicator held in the top-slide, a reading was taken by passing the indicator over the top of the bar, by feeding the cross-slide. Moving the saddle a little to the right, a corresponding reading was taken over the tailstock barrel,

the difference in the readings giving, of course, the exact difference of the centre heights. It then only remained to machine nearly this amount off the top of the tailstock base, leaving a small amount to scrape off to a finish. Care was, of course, taken that an amount of equal thickness was machined off over the whole surface. Tests were repeated as scraping proceeded, until the required degree of accuracy in centre height was obtained, care being taken that the vertical alignment of the barrel was maintained.

It should be noted by those who may be engaged on a similar task of aligning a lathe or other tool that the most scrupulous cleanliness is essential when the tests are made. The smallest particle of foreign matter between the mating surface will give a false indicator reading and render the test valueless. It may, indeed, lead to the scraping away of a surface in quite the wrong place. No pains should be spared; clean the surfaces in the most thorough manner and a final inspection through a lens is advisable. In addition, all other parts of the machine should be cleaned down so that there is no possibility of particles of swarf and the like falling down and fouling the prepared surfaces when the parts under test are being assembled.

Another important point should be remembered. A lathe of the highest degree of accuracy can be made incapable of accurate work if it is distorted when bolted down to the surface on which it rests. If it is a bench lathe, as in the writer's case, the surface of the bench should be trued up until it is quite flat and care should be taken to see that the bases of the lathe legs are flat and lie in the same plane. The bolting down will then have no tendency to twist the lathe bed. The same considerations apply to lathes mounted on floor standards, but as it is usually out of all question to true up the floor, any matter of irregularity can be corrected by placing wedges or other packing beneath the lathe supports as required.

These notes on alignment conclude this article. Many details have been omitted in the description as experienced readers will realise, but their experience will no doubt enable them to bridge the gaps. In spite of the amount which has been written, it has not been possible to deal with the construction in detail. It is hoped, however, that details which have been presented will be of interest and that the comments on the design in particular, and those on lathes in general, will be acceptable to those readers who are interested in model engineers' chief machine tool.

A Magnetic Clock Escapement

(*Continued from page* 552)

from one peak to the next at each full swing of the pendulum. At the same time, the mutual attraction between the two magnetic elements will tend to keep up the swing of the pendulum, the motive force being supplied by the gear train in the usual way.

It should be noted, however, that the " escape " of the wheel is not sudden and intermittent, as in other forms of escapements, but—provided that the shape of the ring is of true *sine* wave form—will be at a perfectly constant rate, and, therefore, a property which has been sought by clockmakers for years—a silent action—is automatically obtained. The constant rate of movement is also of great value in special forms of chronographs and astronomical clocks, as the minimum increment of time measurement is no longer limited by the rate of pendulum or balance swing, as hitherto.

Under these circumstances, the magnet pulls the pendulum at its natural speed, whatever that may be, at any point in its path, by complying with the laws of harmonic motion. This feature is not absolutely essential to the successful operation of the clock, which will work an " armature " of any wave form which corresponds to the pitch of the magnet poles; but it is an important factor in its mechanical efficiency. Under optimum conditions, energy is transferred to the pendulum in the most economical possible way, and the driving force can be reduced to about one quarter that of ordinary clocks. This enables a clock to work on a smaller driving motor, weight or spring, or enables the same applied force (in foot-pounds) to drive it for a longer period of time.

The two examples shown in the photographs illustrate how the principles above described may be applied in modified forms of design. In both these movements, an inversion of the magnetic arrangement is used, the magnet being carried on the pendulum-rod and the " armature " on the revolving shaft. The first of these examples has a two-pole ring magnet encircling a disc with a crinkled edge, conforming in contour with the *sine* wave form; the second has a magnet of somewhat similar type, but altered in shape to bring the poles closer together; it swings in proximity to a star-wheel on a shaft at right-angles to the plane of swing, in such a way that the magnet follows the peripheral deviation of the teeth. The material commonly employed for the magnets in various types of escapements is a 15 per cent. cobalt steel, which is capable of being worked by forging, machining or blanking in an annealed state, and subsequently hardened before magnetising. Higher efficiency magnet steels such as " Alcomax " or " Ticonal " enable smaller magnets and greater air gap tolerance to be used, but are less tractable, being produced only by casting or sintering, and cannot be shaped except by grinding. The armatures are made of Mumetal, which has a higher magnetic permeability than any available magnetic material.

The development of clocks operating on these principles has been carried out by Horstmann Clifford Magnetics Ltd., Newbridge Works, Bath.

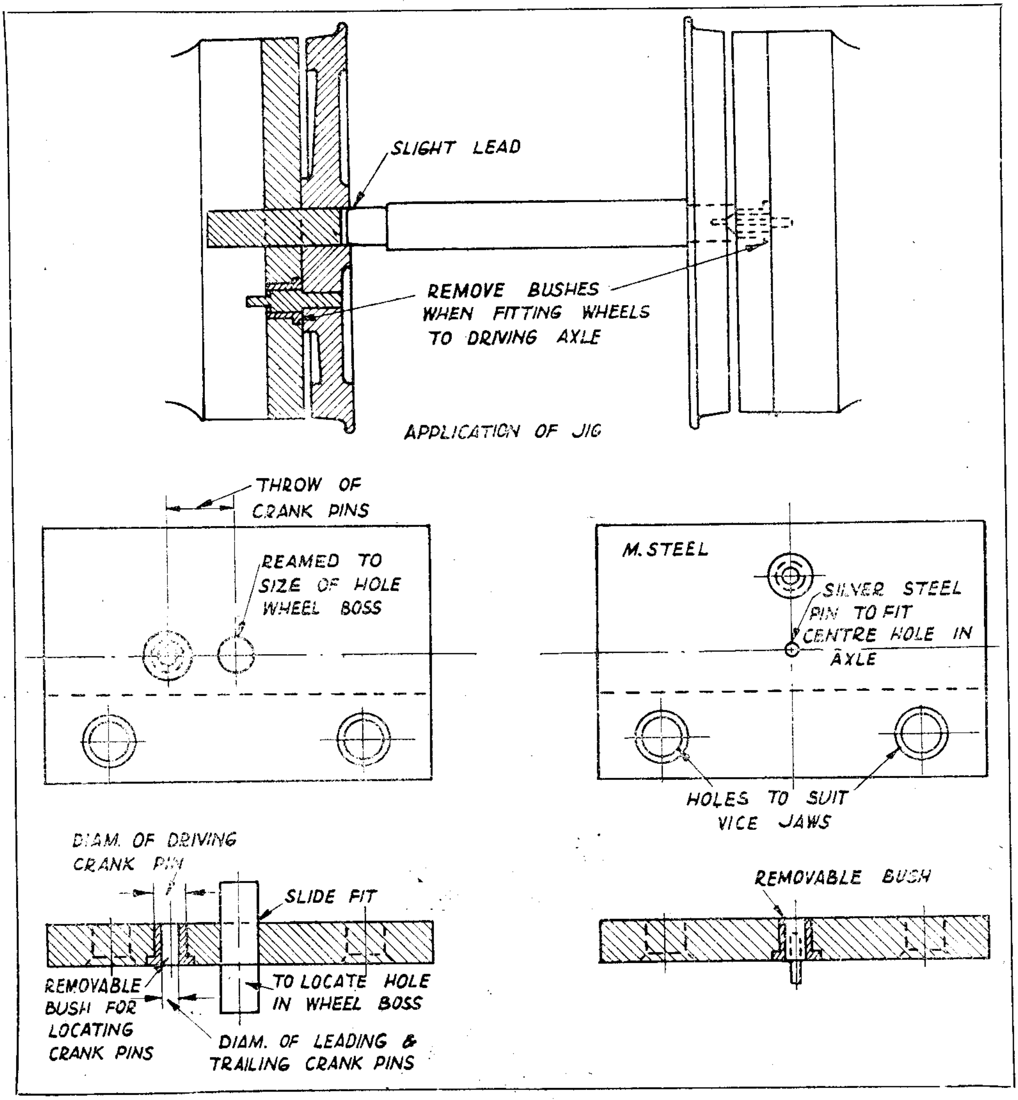
Quartering Wheels on Axles

by I. W. Watkin

HAVING experienced a certain amount of difficulty in quartering wheels successfully by the usual method of applying the scriber and gauge, I felt that something rather more positive should be contrived. The accompanying sketch indicates the outcome of several hours' pleasant contemplation on this problem.

The idea amounts to nothing more than a pair of steel jigs used in place of the normal vice jaws. I do not propose entering into a lengthy description, as a glance at the sketch should give some idea of what I have in mind. Dimensions have been omitted, as these will obviously vary according to the size of wheels and vice used in the operation.

I would add that this contraption has prove quite satisfactory in use and has the advantage of being quickly made ; and should an error creep in during its manufacture, the consequence of which might alter the 90-degree angle, then " all things being equal," free running of the connecting-rods will still be a certainty.

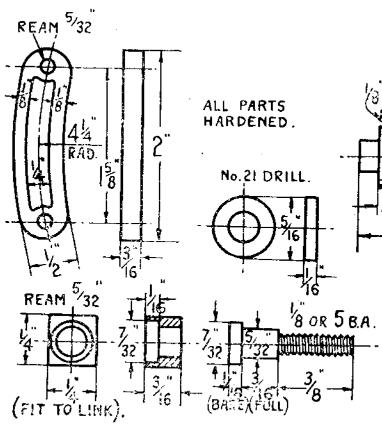


Link Motion for "Maid of Kent"

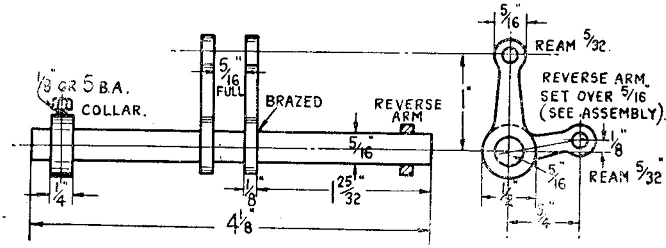
by "L.B.S.C."

THE reversing-arm is filed up from the same section steel, fitted the same way, and off-set $\frac{5}{16}$ in. as shown in the cross-section of the assembly, so that when erected, it lines up with the frame and obviates any necessity of setting the reach-rod in when that component is fitted. You can have the reversing-arm whichever end of the shaft that you prefer. When the "L1" class were first built, the engines were "right-handed," that is, the right side of the footplate, looking towards the chimney, was the driver's side; and the reversing-gear, brake-valve, and the other blobs and gadgets operated by the worthy throttle artist were all placed on the right. Nowadays the left side is the driving side, which is more handy, as most of the platforms and signals are on the left; and when you have a whacking great boiler completely blotting out the opposite-side view from your cab window, this is a great advantage. Incidentally, all our Brighton engines were left-hand drive; and the only objection raised by "right-handers," that it was more awkward to fire left-handed, didn't apply, because all our firemen started left-handed and never fired any other way. It never worried me, anyway, because right from childhood I could use both hands, and still change from one to the other when filing or hammering, if one wrist begins to ache. In case new readers wonder how we got on when running bunker first with a tank engine, we used to look out for certain advertisement signs on the opposite platform; and by stopping opposite them, would pull up with the first-class compartments nearest the ticket barrier (a rule on the old Brighton—first-class passengers did the least walking!). This worked fine, but occasionally an absent-minded driver would mix the stations and pull up opposite Colman's Mustard when he ought to have stopped at Beecham's Pills; then the general manager would get a taste of the condiment mentioned, in the form of an irate letter from some pompous old personage who, with a gouty toe, found walking the length of the platform a rather painful process! Yes, those were the days; I'd gladly sacrifice what is left of my life, for a couple of weeks or so, back on the old job with *Wigmore*, *Purley*, or old *Fairlight*, care-free and coupon-free!

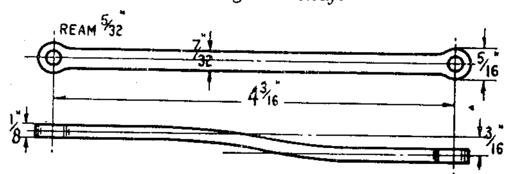
Returning from the land of dreams, after setting the reversing-arm to the angle shown, and $\frac{3}{16}$ in. from the end of the shaft, braze all three arms in position; merely apply some wet flux around the shaft, close to the arms, blow up



Expansion link



Weighbar shaft



Valve-rod

to bright red, touch with a piece of 16-gauge soft brass wire or Sifbronze, quench out in water, and clean up. For the opposite end of the shaft, make a little collar $\frac{1}{4}$ in. wide, from a bit of $\frac{5}{8}$-in. round steel, and fit a $\frac{1}{8}$-in. or 5-B.A. set-screw in it. Poke a 5/32-in. parallel reamer through the holes in the ends of the lifting-arms.

If cast brackets or bearings for the shaft should be unobtainable, cut them out of a bit of $\frac{3}{16}$-in. brass plate to the shape and dimensions shown; another simple job needing no detailing out. Drill and ream the bearing hole, but not the screw-holes yet.

Last, but not least, make two lifting-links to dimensions given, from $\frac{5}{16}$-in. by 5/32-in. rod, recessing the middle as shown, so that the links will clear the eccentric-rod forks, as shown in the cross-section of the assembly. Now, before I forget it, please note this:—Commercial reamers vary; my 5/32-in. reamer, for instance, reams a hole an exact fit for a piece of 5/32-in. silver-steel, and on that I base my instructions to ream a hole the same size as the pin which should fit it. Your reamer may be a bit undersize,

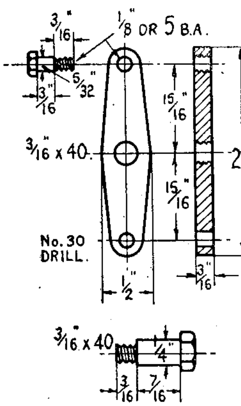
or it may be over; so before finally reaming, check it and see if it is accurate. If it isn't, either get one that is, or use pins to suit the holes made by your present reamer. Taking precautions saves a lot of time!

How to Erect the Valve-gear

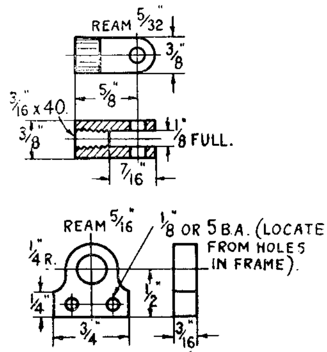
Some good folk get into as much tangle erecting the bits and pieces, as they would do in assembling a jig-saw puzzle. In both cases it is easy enough when you know how. In the present instance, first try the rocking levers in position, to make certain that they swing freely

the fulcrum pins. Put on the back halves of the eccentric-straps; not permanently, as they have to come off again for valve setting. Screw the valve-spindle forks on the spindles; put the valve-rods in position (see plan of motion) connecting to the rockers with the little pins already made, and using a piece of 5/32-in. silver-steel, shouldered down to $\frac{1}{8}$ in. at each end and furnished with nuts, through fork and valve-rod.

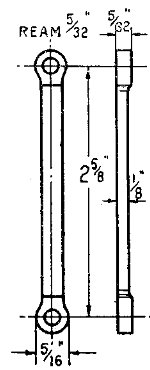
Next item is to drill the holes for the screws holding the weighbar-shaft in position. Note carefully: at $3\frac{1}{2}$ in. ahead of the centre of the



Rocker



Top: Valve spindle fork
Bottom: Weighbar shaft bracket



Lifting link

without shake when the fulcrum-pins are screwed up tightly, with a washer under the head of the pin. If they bind, thin the washer a shade until O.K. Then take them out and fit the die-blocks to the bottom of each, making certain that they, too, are quite free to turn when the nuts are tight, as previously mentioned.

Next, put one right-hand and one left-hand eccentric fork over the ends of an expansion link, as shown in the plan view, so that the straps can lie side by side. Note particularly that the fore-gear eccentric rod is the one nearest the crank on each side, and is connected to the top of the link; the ones nearest centre, at each side of the pump eccentric (the middle one) are the back-gear merchants, and are coupled to the bottom of the links. Pin the forks to the links by driving pieces of 5/32-in. silver-steel through the lot; this should be a drive fit in the forks, and a working fit in the links. The pin in the upper fork is filed flush both sides; that in the lower fork projects 5/32 in toward the centre line of the engine, to take the lower end of the lifting-link. Put the eye of the lifting-link over it, enter the die-block on the rocking lever into the slot in the expansion-link, and drop the whole bag of tricks into place on the inner side of the rocker bracket. The back halves of the eccentric straps should have previously been taken off, and when the above stage of erection is reached, the front halves can be guided on to their respective eccentrics at the same time.

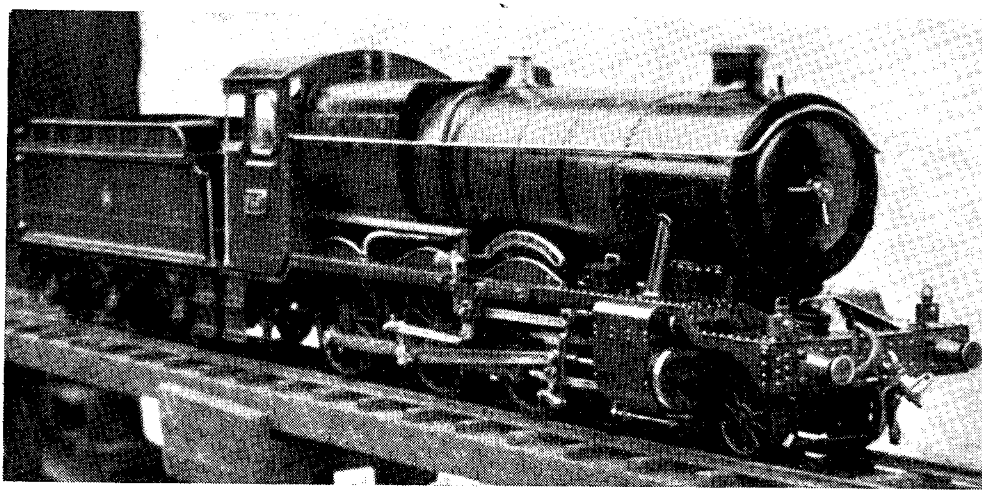
Line up the centre holes in the rockers, with the bearing holes in the brackets, and put in

driving axle, and $\frac{3}{16}$ in. below the top of frame at this point, drill a No. 30 hole, and another one $\frac{1}{2}$ in. behind it (nearer the axle) and at the same level. Countersink on the outside. Ditto repeato on opposite side of frame. Put the little collar on the weighbar-shaft, at the opposite end to the reverse arm, and $\frac{3}{16}$ in. from the end; then hang a bracket or bearing on each end, place in position "by eye," and hold the bearings temporarily to the frame with a couple of toolmaker's cramps. Adjust weighbar-shaft until it stands square and level across frames, $3\frac{1}{4}$ in. ahead of centre of driving axle, and $1\frac{7}{8}$ in. above centre line of motion, which is the middle of the guide-bars. Run the No. 30 drill through holes in frame, making countersinks on the weighshaft bearings; follow with No. 40, tap $\frac{1}{8}$ in. or 5-B.A. and put countersunk screws in; see cross-section of complete assembly. Put the upper ends of the lifting-links between the lifting-arms, secure with a bolt made from a bit of 5/32 in silver-steel shouldered down to $\frac{1}{8}$ in. at both ends and nutted, and Bob's your uncle as far as erecting the valve-gear is concerned. Don't put the set-screws through the lugs on the front of the motion-plate into the guide-bars yet, until the packing and jointing of the cylinders has been completed, and they are ready for permanent erection.

Miscellaneous Items of Interest

In view of the locomotive exchanges among the several regions of British Railways, and the possibility of various components of one region

being applied to engines of others, the reproduced photograph may be of added interest. The locomotive is the conception of a shy reader in the Black Country who prefers to remain anonymous. However, for all we know at time of writing, our bashful friend may have anticipated something that will actually happen; remember my "Purley Grange," with full-length plate frames, plate-framed bogie, separate cylinders and smokebox saddle, and other incidentals that were later adopted for the full-sized engines?



"Bro. Shy" mixes the breeds—but the engine does the job!

The locomotive illustrated is in general dimensions, a cross between a "Hall" and a "Grange," though she bears the name of "Cordley Hall." The coupled wheels are $4\frac{1}{4}$ in. diameter, and the bogie wheels $2\frac{1}{4}$ in. The cylinders are $1\frac{1}{4}$ in. bore and $1\frac{1}{2}$ in. stroke, the valve spindles being set outwards instead of inwards as on regular G.W. engines, owing to the use of an outside Walschaerts' gear. This is generally similar to that found on L.M.S. engines, but differs in having the radius-rods lifted and lowered by a drop-link or lifting-arm connected to the radius-rods behind the link instead of in front of it, this arrangement taking the place of the L.M.S. type of slotted radius-rod lifted by a die directly attached to the lifting-arm. The arrangement shown works well and gives perfectly satisfactory operation. Lubrication is effected by a mechanical oiler, same as the one I described for "Maisie"; and that lady's type of safety-valve can also be found under the G.W.R. brass cover. Other details on the engine were also described in the "Maisie" construction notes. The boiler is a sort of "semi-Swindon" pattern, with top-feeds supplied by injector and pump. The builder says the engine gave him many happy hours of congenial work in the building, and many more in the running. Congratulations—and here's hoping that one of these fine days he will actually see a G.W.R. 4-6-0 tried with outside Walschaerts' gear. I'd like to see it myself; and why not, when a L.M.S. engine of the same type has been built with an outside Stephenson link-motion?

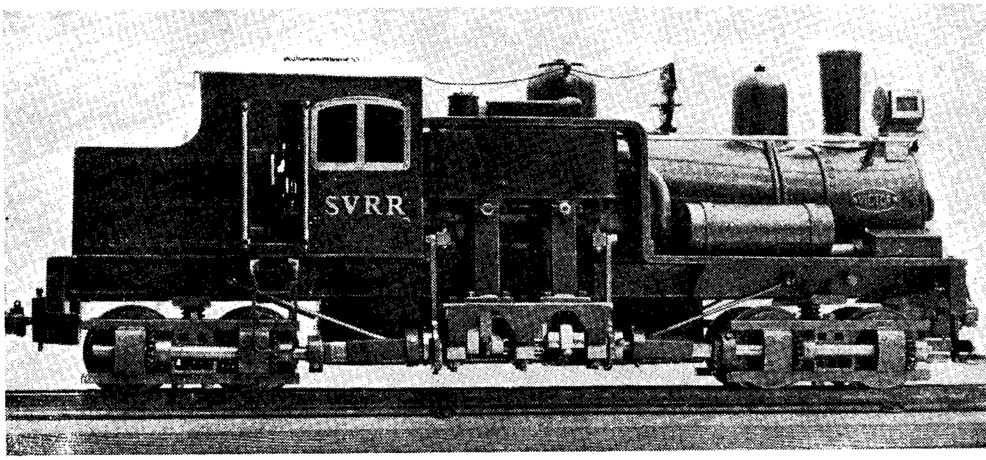
Bob Walsh's Last Job

It was with deep regret that I heard of the sudden death of Bob Walsh, of Bolton, Lancs., as I had received a letter from him not so very long before, saying that our good friend "Dick Turpin" of Enfield wasn't going to have it all his own way with "Likeada," because he actually was building the ten-coupled "Ada" in $3\frac{1}{2}$-in. gauge. He enclosed a photograph showing progress up to time of writing. "Brother Bob" liked Stephenson link-motion because the lead increases as the gear is notched up, and so was adapting the valve-gear which I specified for "Maisie," in place of the outside Walschaerts' gear on the full-sized "Ada"; the exact opposite to the arrangement of the engine mentioned in the preceding paragraph. The boiler has a combustion-chamber and four $\frac{3}{4}$-in. superheater flues.

Our friend has also built "Maisie," "Molly," "Fayette" and other engines described in these notes, and was pleased at the results obtained, confirming my assertion that "Fayette's" boiler would steam from all cold in $3\frac{1}{2}$ minutes. I am sorry to lose yet another correspondent-friend; and although I never met him personally, I feel that if his personality was as expressed in his cheery letters, he will be sadly missed by the locomotive building fraternity in the Bolton area, also by the kiddies. In his last letter, he said he was applying for petrol coupons, so that he could take his locomotives around, and not disappoint the children.

A Steam "Sidewinder"

Here is a picture of a little steam "sidewinder" that is not quite as dangerous as the American snake that bears that nickname. She was built by Vic Messer, an Australian enthusiast whose work has been illustrated before in these columns. The little engine is of the



Mr. Vic. Messer's narrow-gauge "Shay"

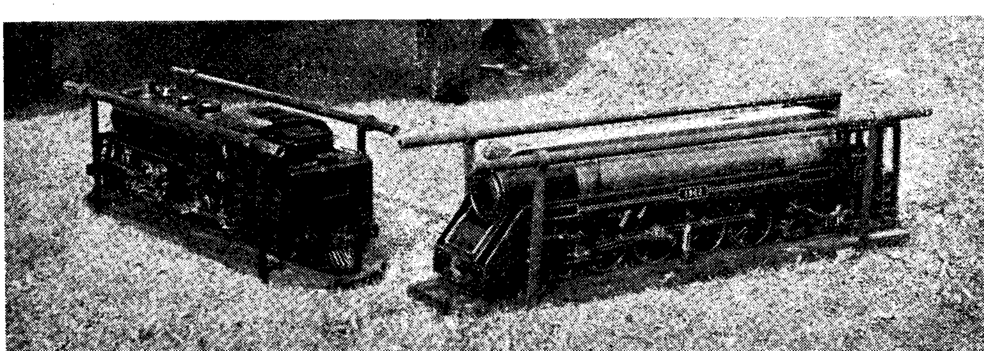
Shay type, and as she represents a narrow-gauge engine, is rather larger than the usual "O"-gauge outfit, being approximately to $\frac{3}{8}$-in. scale. The two cylinders are $\frac{3}{8}$ in. bore and $\frac{3}{4}$ in. stroke, driving the usual side shaft which is geared to all the wheels of the engine, making her full weight available for adhesion; but unlike the full-size Shay engines, which are geared down so that crankshaft speed is much below axle speed, the gear on the little engine is 1-to-1, so that she loses in power but gains in speed.

The boiler is of the water-tube pattern, and fired by a spirit-burner. The overall length of the engine is 13 in. and the height to top of chimney 5 in. Although such locomotives are not found in this country, this type has much to recommend it for a sharply-curved line in a back garden, as it makes a continuous track possible; and if geared down at, say, 4-to-1, a $2\frac{1}{2}$-in. gauge edition would easily haul as much as the average $3\frac{1}{2}$-in. gauge engine of normal type. Another advantage is that the speed would not be high enough to derail the whole outfit very easily, though the speed of a small geared-down Shay would be far higher in proportion than its full-sized relation.

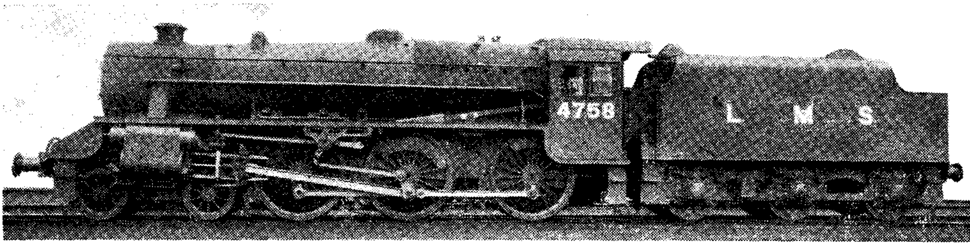
The Right Way to Carry 'em Around!

Recently, I received from some of our friends in U.S.A. and Canada, some batches of photographs of "track meets" held on the other side of the big pond; and in these days of petrol restrictions, the array of cars parked at or near the trackside, makes one feel—well, envious, shall we say? One thing that interested your humble servant was, that there doesn't appear to be any of the "dump-it-in-the-back—it'll-be-all-right" sort of antic about our cousins; when they have a good mileage to cover between home and the place of meeting, the locomotives need to be safely carried and easily handled.

Here is a picture showing how Jim Turnbull plays for safety. He uses a stand consisting of a wooden base with rails on it, on which the locomotive rests. There is a pillar at each corner, and long pieces of tube pass through the pillars extending beyond them at each end, forming handles, so that the engine is easily lifted and carried by a willing helper at each end, with no fear of dropping the lot, or other chance of accidental damage. I heartily commend this system of transportation to club members who own big engines of 5-in. gauge or over.



A safe way of carrying engines to the track



Broadside view of Class 5P 4-6-0 No. 4758 locomotive (Walschaerts valve gear and Timken roller-bearing)

THEME and VARIATIONS

by J. N. Maskelyne, A.I.Loco.E.

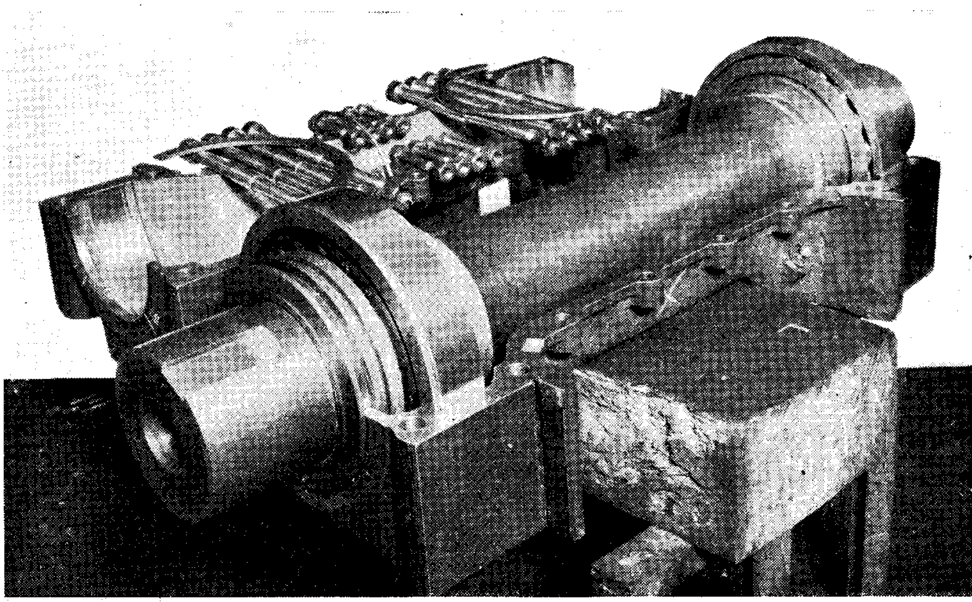
AMONG the most successful locomotives operating in Britain, at the present time, the mixed-traffic 4-6-0 of the former L.M.S.R. must take a prominent place. They are popular with the enginemen as well as with the travelling public, and are officially designated "Class 5," they are almost universally and affectionately known as "Black Staniers."

The first examples of this class were built to the designs of Mr (now Sir) W. A. Stanier, in 1934, and by the end of 1947 no fewer than 732 engines of the class had been built and put into traffic.

They constitute one of the largest individual classes of mixed-traffic engines in this country and details of them are generally well known. They are provided with two outside cylinders and piston valves operated by long-travel Walschaerts gear. The axleboxes are of the normal "plain bearing" type.

At the end of January last, I was privileged to visit Crewe Works for the purpose of inspecting some examples of the latest order for engines of this class, and I must say that I found them to be extremely interesting on account of the variations of detail they exhibited, not only among themselves but as compared with the very large number already in service; and I am indebted to The Railway Executive, Midland Region, for the following information and for the illustrations accompanying these notes.

In order to explore the possible advantages of



Timken cannon axlebox with top half removed to show races

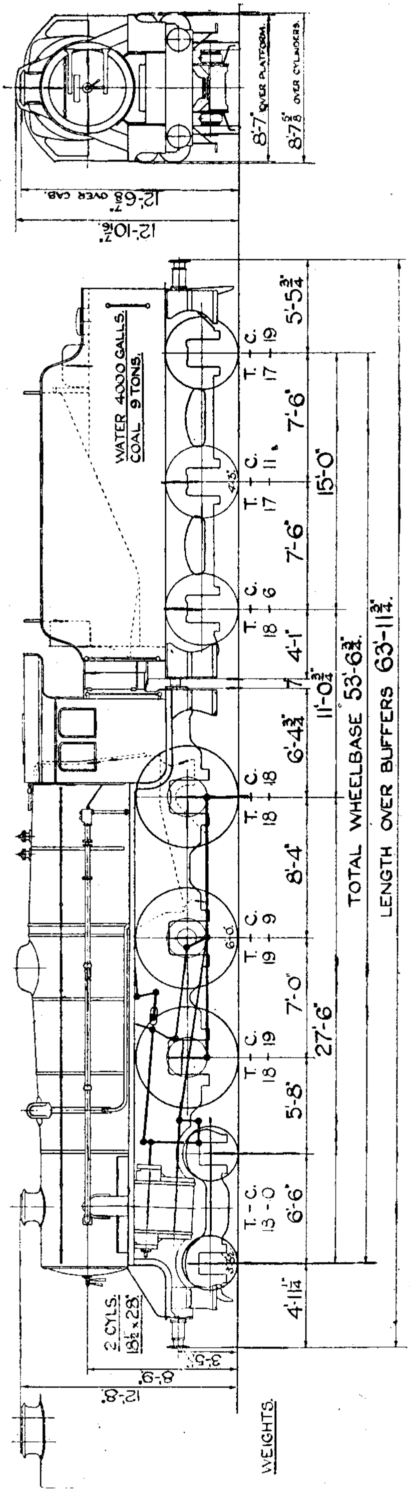


Diagram of Class 5 engine as fitted with Timken roller-bearings, B.R.M.R.

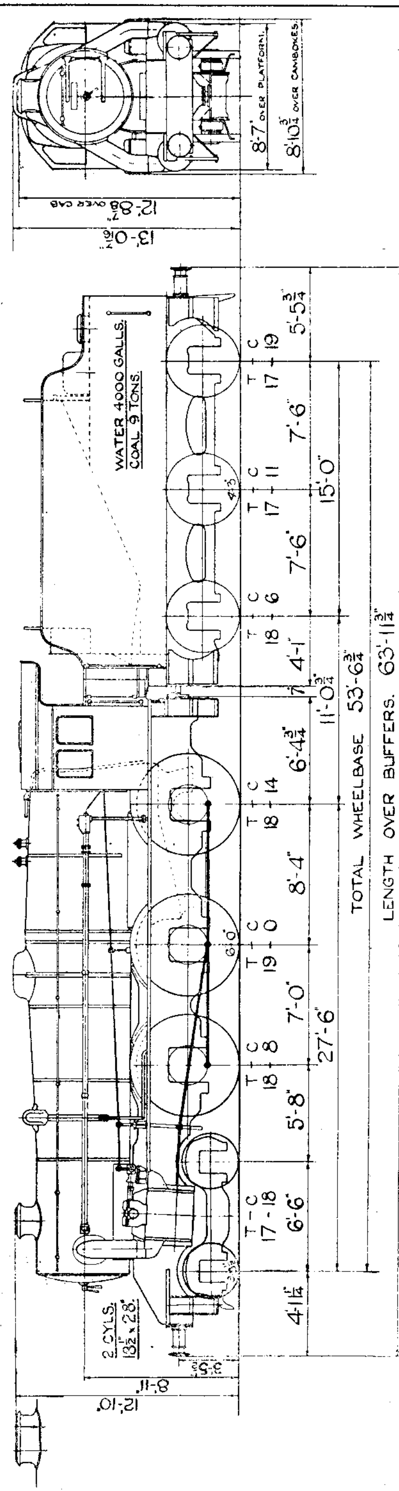
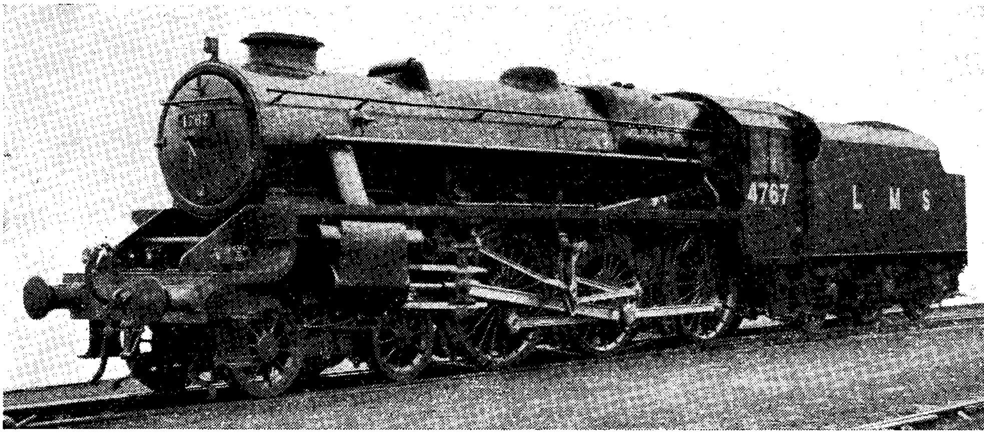


Diagram of Class 5 engine as fitted with British-Caprotti valve-gear, B.R.M.R.

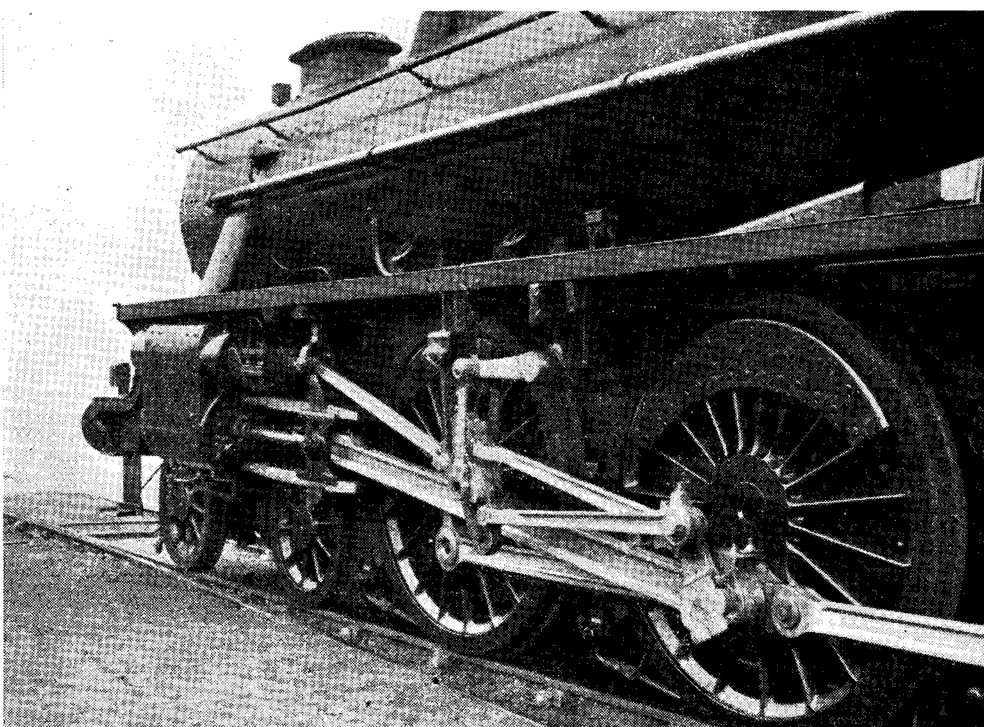


Class 5P 4-6-0 No. 4767 (Stephenson's link motion, Timken roller-bearings and double chimney)

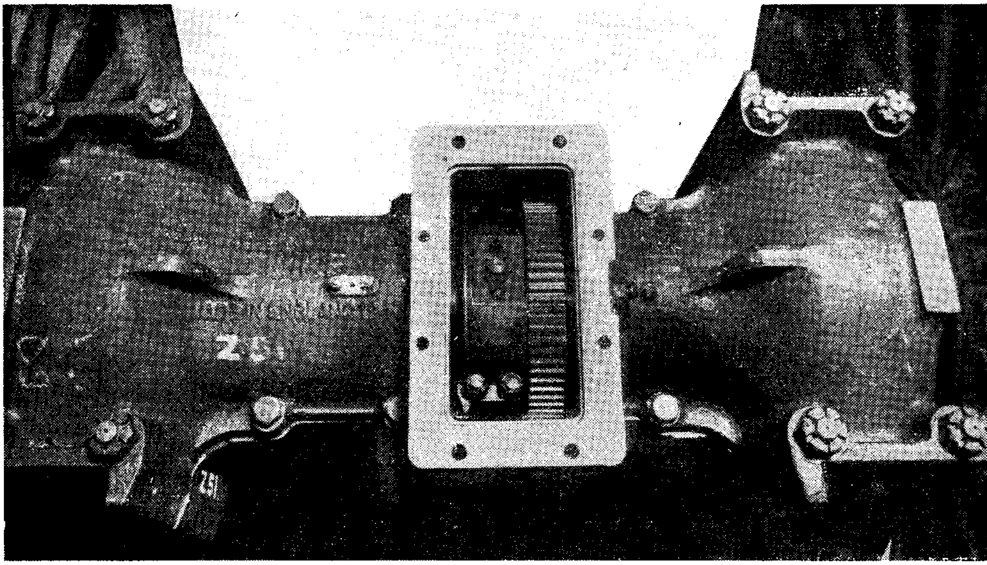
roller-bearings and poppet valve gear, the following additional engines of the same general design have been completed or are under construction : Ten with British Caprotti valve gear and plain bearings ; ten similar, but with Timken roller-bearings, and ten with piston-valves and Timken roller-bearings.

These locomotives are being built to the designs of Mr. H. G. Ivatt, M.I.Mech.E., Chief Mechanical Engineer. The main purpose of the experiments is to increase the availability and mileage between shop repairs and to reduce the cost of maintenance and the work entailed in the running sheds.

Special cost records are to be kept of the above in order to assess the relative financial benefits that accrue from the various arrangements ; and a number of standard engines being built under the



Close-up of Stephenson's valve-gear on Engine No. 4767



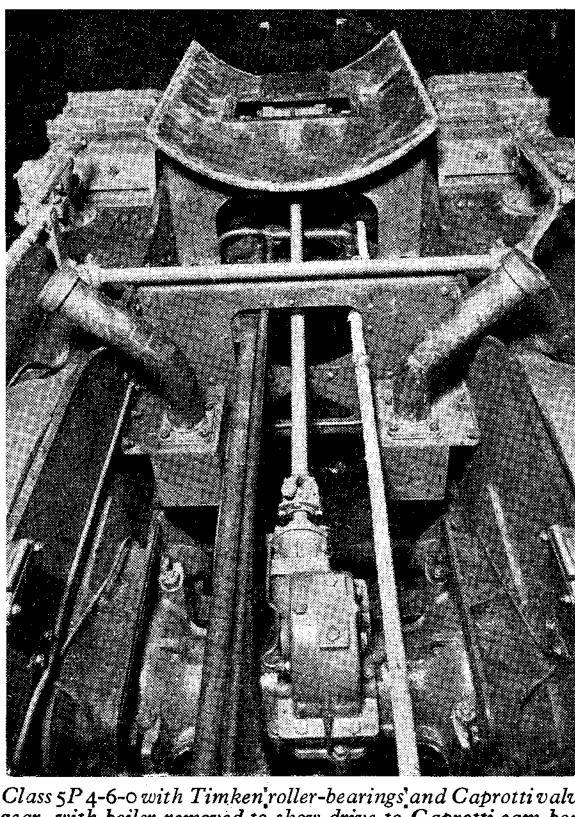
Timken cannon axlebox, showing drive for Caprotti valve-gear

same programme are also to be costed, so that comparative records can be obtained with the minimum of outside variables.

In order to accommodate the roller-bearings, it has been necessary to lengthen the coupled wheelbase by 4 in. and the boiler has been raised by 2 in. A slight increase in the total weight has resulted from the fitting of this equipment.

All the roller-bearing axleboxes are fitted with Timken taper roller - bearings and have manganese steel liners welded on to their guide faces. Manganese-steel liners are bolted to the axlebox guides or hornblocks, in accordance with the latest practice. The coupled wheel axleboxes are of the cannon type, the casings being split horizontally to allow them to be assembled on the axle after the cones and wheels have been pressed on. The bogie and tender axleboxes are of similar type but are individual boxes. The casings of these can be removed by taking out the bearing bolts in the usual way, thus allowing the bearings to be inspected. The bogie has inside bearings and the tender outside. The lubrication of the Timken roller-bearings is by oil.

Manganese-steel liners are also fitted to the guide faces of the coupled wheel axleboxes and guides of the engines fitted with plain bearings.



Class 5P 4-6-0 with Timken roller-bearings and Caprotti valve-gear, with boiler removed to show drive to Caprotti cam-boxes

(To be continued)

Broken Taps and Studs

by J. W. Tomlinson

MUCH trouble can be avoided by way of broken taps and studs if the model engineer took the proper precautions when tapping and fixing studs. The reasons for the breakages are not many, and if they are considered and borne in mind when the operation takes place, far less breakages would occur.

when running down the final tap, and not thinking, the bottom is suddenly reached, giving the tap a jolt and breaking it. In the case of a broken hole, great care should be taken as the tap is passing the break, otherwise, pieces of metal will be drawn in, causing the tap to jam and break. See Fig. 2.

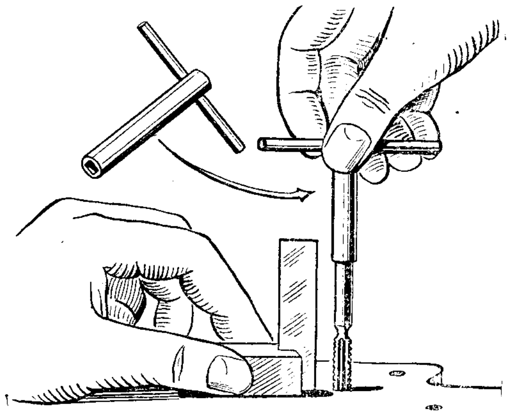


Fig. 1. A good set-up for tapping

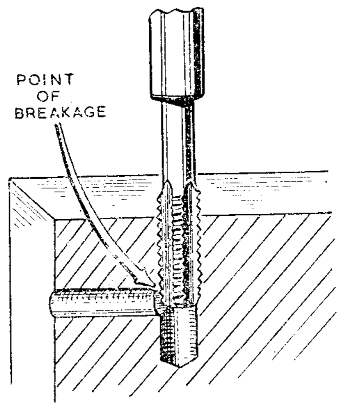


Fig. 2. Tapping a broken hole

Why Taps Break

One of the simplest ways of breaking a tap, apart from letting the mind wander, is to try to square the tap up by "drawing" it; that is, putting extra pressure on one side in an effort to make the tap cut square. Not only does this result in breakages, but it produces a "bell-mouthed" hole. A certain amount of "drawing" or "pulling" is permissible with a taper tap when only the taper portion is cutting, but by the time that the full diameter is at work, any further "drawing" is extremely dangerous.

Perhaps the next easiest way to break a tap is to use the wrong type of tap wrench. A wrench which is too heavy or has too much leverage will make the tapping of small holes very difficult. The best type of wrench to use is the "T" wrench, as shown in Fig. 1. These wrenches can be made from squared tubing fitted with a tommy-bar. The squared end should be a loose fit on the tap so that it can be withdrawn and replaced with ease, when checking with the set-square. The amount of twist or torque that a tap will stand without breaking, can only be judged by the "feel" of the tap, and with a heavy wrench and long tommy-bar, this is very hard to determine.

Another reason for tap breakages is using an undersized tapping drill. This applies especially when tapping holes in tough metals such as stainless-steel, therefore, care should be taken to see that all tapping holes are of correct size. Blind holes can cause a breakage, as can holes which break through into another hole. In the case of the former, the trouble generally occurs

Forcing a plug tap into a hole without first using a taper tap, is another cause of breakages. This method might work all right in the case of duralumin and other soft metals, but with steel and brass, a taper tap should always be used first, and when dealing with tough steels, two taper taps should be used. Lack of lubricant or the wrong type of lubricant can be the cause of a tap breaking, although when tapping in cast-iron it is usual to use the tap dry.

Maybe the model engineer is sometimes apt to blame the tap when it breaks, but faulty taps are very rare. The only taps of this type one is likely to meet, are those of unknown origin, and the only place for this kind of tool is the scrap-box.

Broken Studs

The reasons for stud breakages are not so many, but care should be taken, as a broken stud can cause a lot of trouble. The chief reasons are, too much interference between the stud and the tapped hole, and the use of the wrong type of spanner when inserting the studs or tightening the nuts.

When tapping holes in duralumin and other light non-ferrous metals in sizes of 2-B.A. and larger, the tap should be 0.002 in. smaller than the stud. This is to prevent the stud stripping the thread in the softer metal when the nut is tightened. In steel and brass, this interference is unnecessary, and all holes should be tapped standard size. If on inserting the studs they begin to tighten after the first two or three threads, they should be removed before it is too late, and

the hole re-tapped. It may be found that the stud thread is the wrong pitch, or the tap may be slightly taper, but whatever the trouble, do not drive the stud in using a big wrench and hoping for the best. This will only lead to broken studs, hard words, and a lot of extra work.

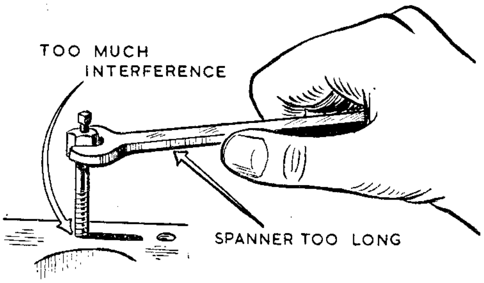


Fig. 3. Two causes of stud breakages

As with tapping, the right sized wrench is of great importance for the prevention of broken studs. By right size is meant not just one that fits the nut, but a wrench that also fits the stud. If a large tommy-bar is used in conjunction with a box spanner or a badly designed jaw spanner is used, difficulty will be experienced in gauging the amount of torque applied, and this is the first step towards breaking a stud.

With experience one can "feel" the stud, that is, it is possible to tell by the feel when the stud starts to stretch prior to breaking. This is the reason a mechanic with years of experience rarely breaks a stud, he knows just when to finish tightening. This ability to feel can be reached more quickly by using the right tools and keeping the mind on the job as the stud is inserted or the nut tightened.

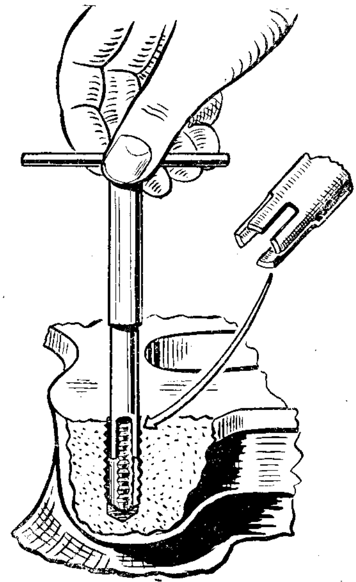


Fig. 5. Using the pronged tool

It should be remembered, that a stud which has been in use for several years, especially working under high temperatures or in constant vibration, tends to become brittle, or crystalised.

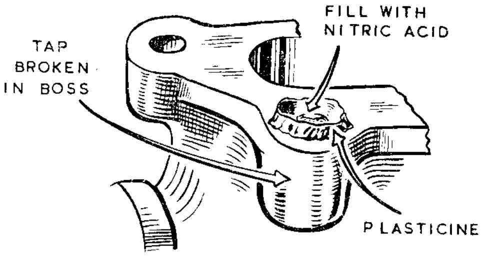


Fig. 4. Burning out a broken tap

These studs should be treated with respect even by the experienced, as they are liable to snap off without warning.

Removing Broken Taps

The removal of a broken tap can be quite a problem for the model engineer. When a large portion of the tap is protruding from the face of the model, it is comparatively easy to remove the tap with a pair of pliers, but when the tap is broken off flush, great care must be taken, otherwise a very valuable part of a model may be scrapped. There are various ways of removing taps that are broken off flush, and some of the methods most suited to model-makers are given in the following paragraphs.

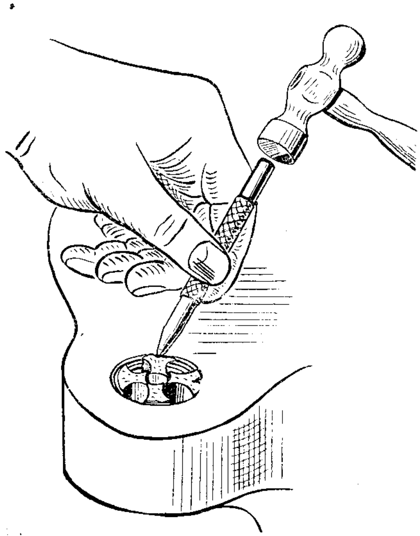


Fig. 6. Removing a softened tap

When a tap is broken in duralumin, aluminium, or similar soft alloys, special care must be exercised in effecting its removal. To attempt removal by hammer and punch is a very unsuitable method,

owing to the tap digging into the soft metal, damaging the thread and making the hole very much oversize. When dealing with soft metals, the two most suitable methods for the modeller, are the acid treatment (Fig. 4), and the pronged tool method (Fig. 5). The acid treatment is most

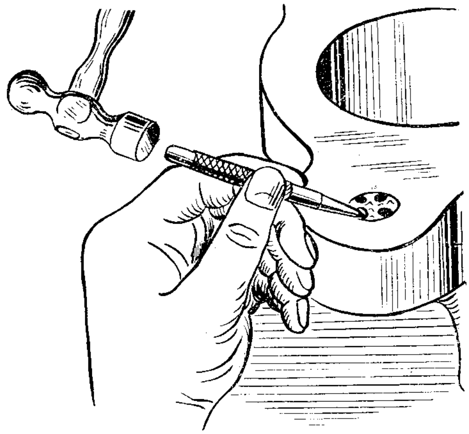


Fig. 7. Punching out a broken tap

suited to small sizes, say for 5-B.A. and smaller, and it is carried out in the following way.

Make a well of Plasticine around the broken tap as shown in Fig. 4. If the hole is open at both ends, the bottom should be plugged also with Plasticine. Stand the model with the affected face level and fill the well with nitric acid. Adjacent steel parts should be covered with grease to prevent rusting, and the job should then be left for the acid to work. After about two hours, or more frequent if possible, tip out the old acid and replace with fresh, taking care that the acid does not contact the fingers or clothes. Continue the treatment until the tap is loose and can be removed. In some cases the process may take many hours, but if the model is valuable, this method may well prove worth the trouble. After the tap has been removed, wash the model in boiling water to remove all traces of acid. If the process has taken a long time, it may be found necessary to tap the hole out the next size larger, due to the acid attack on the soft metal.

The second method which is more suitable for sizes ranging from $\frac{3}{16}$ in. and larger, is to use the pronged type of tool shown in Fig. 5. These tools can easily be made in the model engineers' workshop, but it is emphasised that they must be made of tough steel.

When dealing with extra tight taps, a good way of making this type of pronged tool is to drill and slot a straight drill shank, squaring the other end for spannering. A simpler way is to make one from a piece of tubing, and drill for a tommy-bar, but if mild-steel tubing is used, too much should not be expected, as the prongs will very likely give way under heavy pressure, especially when dealing with small sizes.

The pronged tool method is quite useful for removing taps broken in steel and other hard metals. The acid treatment should not, of course, be used on steel, but a method to take its place is to soften the tap and remove by drilling. The approach to this method must be considered carefully or the hole will be made over-size. The aim should be to drill out the centre of the tap and then collapse the threaded portions inwards, as shown in Fig. 6.

Sometimes when a tap is not too tight, it can be punched round one or two turns, making it protrude sufficiently to grip it with the pliers. When this method is used a small centre punch and a light hammer are the most suitable tools, and the angle at which the punch is held is most important. A good angle is shown in Fig. 7, and when carrying out this work the tap should be punched alternately from both sides. On rare occasions a tap can be broken up and removed in pieces, but this method is only to be recommended when it is a very small length of tap that is broken in.

Removing Broken Studs

The removal of a broken stud can cause just as much trouble as a broken tap, especially when the job is not tackled properly. For studs which are broken with a fair amount protruding, there are several types of stud extractors available. Although the stud may be protruding a considerable amount, it may be inaccessible due to adjacent studs or the fact that the job is assembled. In instances like these there is no better extractor than the one shown in Fig. 8. It is easy to make and fits over the stud, taking up less room than the nut which fits the stud. To make this tool, a drill shank will again come in useful. This should be drilled a size slightly less than the diameter of the stud to be removed, and then serrated with a three-square file. For a $\frac{3}{16}$ in. stud, the hole

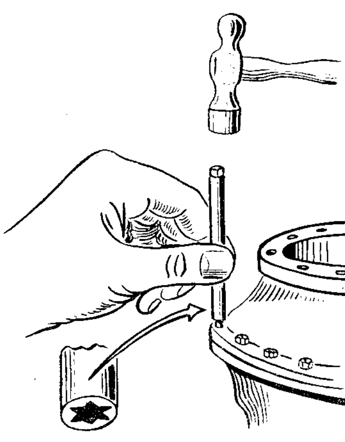


Fig. 8. Using the serrated extractor

should be about 11/64 in. The other end of the shank is squared for the spanner, and after case-hardening the serrated end, the tool is driven on to the end of the stud.

The act of driving the extractor on to the stud will in itself help to loosen it. The tool will, of course, fit only one size of stud, but since they are so easy to make, a range of the popular sizes could be produced and kept as standard workshop equipment.

Another kind of extractor is the "B & T" bell-type, and this is shown in Fig. 9. This works on the cam principle and is capable of dealing with four sizes. This tool is quite useful when there is sufficient room for it to be used, but, as will be seen, it is more bulky than the one first mentioned.

There are several other types of extractors using the cam principle, and these are all for studs protruding. If no extractor is available and it is convenient, the stud can be gripped in the vice and the job rotated, or the stud can be filed square to fit a key spanner. Another way when there is plenty of room, is to use a pair of foot-prints. In all these cases it is a good tip to first hammer

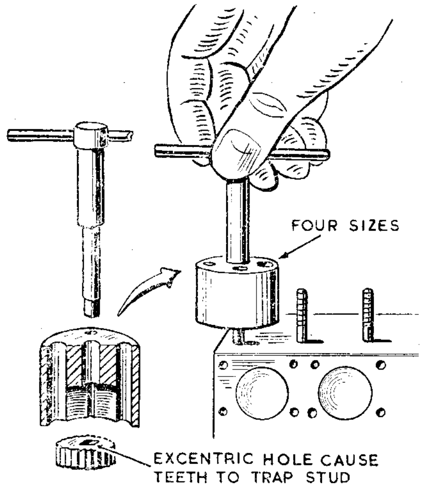


Fig. 9. Using the "B & T" bell-type extractor

the end of the stud to help loosen it. The hammering should be light and the blows frequent.

When a stud is broken off flush, the only course to follow is drilling and removal either by collapsing, or the use of an "Ezy-out" or a piece of squared taper tough steel. "Ezy-outs" are well known in industry and they consist of a length of toughened steel in the form of a left-hand multi-start taper screw (see Fig. 10). A range of sizes is supplied and each one is marked with the size of the drill to be used. The wrong sized drill may easily cause the operation to fail. In use, the "Ezy-out" is simply screwed into the drilled stud, and being a left-handed thread the action unscrews the broken stud. When dealing with left-hand screwed studs, a right-hand taper screw will, of course, have to be used. There are various other similar types of tools in use, some are fluted and others are serrated.

When a stud is drilled for collapsing, it is essential that the hole is drilled as large as possible, but without damaging the thread in the model, therefore the hole should be as near in the centre as is practicable. To help in this matter, it is a good plan to first mark with a centre punch and then check with dividers. The hole should be just started with the drill, and the centre again checked. If the drill has run, the centre point can be drawn back with a centre punch. It is advisable to start with a small drill, and finish with the largest drill possible according to how far out of centre the hole is. This will leave just a shell consisting of the stud thread, which can be punched inwards and screwed out by inserting a file tang.

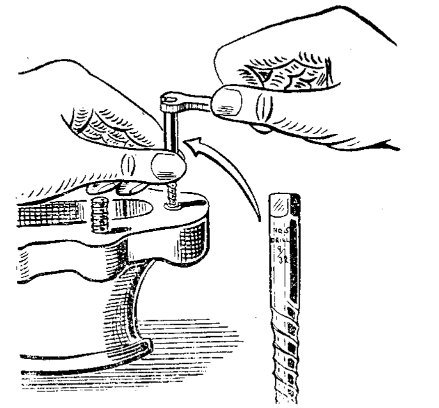


Fig. 10. Using the "Ezy-Out" stud extractor

If no special tools are available, the stud can be drilled and a piece of squared taper tough steel driven into the hole and a spanner or box-key used for unscrewing. Or better still, if the stud is large enough in diameter, the drilled hole can be filed square and a piece of good steel made to fit. A file tang is sometimes used, but if this method is adopted, it should be with caution, and only when dealing with studs which are not extra tight. Another point to remember when using a file, is, never strike the hardened end of the file with the hard face of the hammer. This action may cause bits of steel to fly off and enter the eyes. If a hammer is used on a file, always use the side of the hammer, as this is not hardened.

Machined Units for Locomotive Builders

We have received from Quickset Toolholder Co. Ltd. a copy of their price-list of machined units for the locomotive builder. We have also seen some of the units and can testify as to their excellent quality; they should be more than helpful to builders of miniature locomotives, especially to those who do not possess the necessary workshop equipment to do the machining themselves. The original castings, too, are of first-class quality, whether in iron or gunmetal.

This service is a new venture, and it is not cheap; but the standard which this firm has set itself is certainly a very high one which we can recommend with confidence. We suggest that readers procure this list, price 9d. by post. There is much of interest in it in addition to the machined parts just mentioned; a useful range of boiler fittings, valve-gear sets and certain milling and gear-cutting attachments are in the range. Incidentally, the castings and parts are available for locomotives from $1\frac{1}{4}$-in. to $3\frac{1}{2}$-in. gauges.

Brighton's Exhibition

THE Brighton and District Society of Model and Experimental Engineers organised, during April, a model engineering exhibition which proved to be a great success from every point of view. Over 200 separate items, large and small, and covering practically the whole range of the hobby, were well set out in the Fawcett School Hall, York Place, Brighton, and attracted large numbers of visitors.

The Competiton Section comprised over 80 separate entries and gave the judges, Messrs. J. N. Maskelyne and E. T. Westbury of THE MODEL ENGINEER a busy time.

A somewhat novel planning of the show was put in hand some months before the event, in that Mr. G. H. Davis built a model of the general arrangement of the exhibition and, later, worked to it when setting out the exhibits.

The opening ceremony was performed by The Mayor of Brighton, Councillor P. F. Friend-James, O.B.E., J.P. The presentation of prizes was undertaken, at the end of the four-day period, by the Mayor and Mayoress of Hove, Councillor Capt. and Mrs. F. G. J. Didden, when no fewer than fifteen principal prizes and numerous diplomas were presented to successful competitors.

The prize-winning exhibits, of course, were the best in the show, and were extremely varied in character, for they consisted of :—

A jig-saw machine ; an "O"-gauge steam locomotive ; a radio-controlled steamship ; a large model of an electric generating station ; a model clipper-ship ; an "O"-gauge L.B. & S.C.R. 0-6-0 E2-class tank locomotive ; a 3½-in. gauge L.B. & S.C.R. Atlantic locomotive ; a ¾-in. by ¾-in. high-speed marine engine ; a 3½-in. gauge "Rainhill" locomotive by a lad aged 15½ ; an unfinished 2-in. scale traction engine ; a model of Anne of Cleeves' house at Ditchling ; a 2-stroke petrol engine ; a 6-ft. petrol-driven monoplane ; a 2½-in. gauge 2-8-0 "Austerity" locomotive ; a steam-driven model of H.M.S. *Vanguard* ; a ¾-in. by ¾-in. slide-valve marine engine ; a 1½-in. screw-cutting lathe and "Fairy Fantome" power-driven biplane.

All these models were of excellent workmanship, and we would be glad if the builders would let us have descriptions and photographs of each for publication in THE MODEL ENGINEER.

We understand that the membership of the society has been considerably increased as a result of the exhibition ; so next year's show should be even bigger and, perhaps, more varied.

For the Bookshelf

Walschaerts' Valve Gear, by Henry Greenly. (London: Percival Marshall & Co. Ltd.) 59 pages, size 5 in. by 7¼ in. Price 3s. od. net.

This is a reprint of a popular handbook describing and illustrating, in considerable detail, one of the best-known locomotive valve-gears. The information given is interesting and useful, and we note Mr. Ernest A. Steel has taken the opportunity to introduce some necessary slight revisions, additions and corrections in the text, but more particularly in the drawings. The essential technical considerations which govern the general design of the gear are by no means abstruse, are clearly presented and simply discussed, while the very numerous illustrations are of the greatest value to the student of mechanics. The little volume can be confidently recommended.

The Model Railway Hobby, by M. H. Binstead. (London: Percival Marshall & Co. Ltd.) 268 pages, size 4½ in. by 7 in. Price 10s. 6d. net.

The subject of this book is one that has been dealt with many times and by many authors; but Mr. Binstead's approach to it is different from any other. Here we find no great amount of technical detail or lengthy descriptions of layouts; rather does the book serve as a sort of go-between, with the full-size railway on one side and the model railway on the other. The text, born of practical experience, discusses the multifarious problems which are likely to confront the novice in the hobby, and it provides much helpful advice on every sort of subject associated with model railways. In our copy, the folded insert facing page 10 has been pasted in the wrong way about, and there are a few misprints in the text, minor errors which can be easily corrected in future editions of the book.

Ignition Equipment, by Edgar T. Westbury. (London: Percival Marshall & Co. Ltd.) 192 pages, size 4½ in. by 7 in. Profusely illustrated. Price 8s. 6d. net.

It is probably impossible to lay too much stress upon the importance of a good and reliable ignition system for almost any type of modern internal-combustion engine, except the compression-ignition engine. This latest book from Mr. Westbury's able pen is, at once, the most comprehensive, informative and practical which we have yet seen devoted to this important subject. The greater part of the material was collected during a long period of research into the design of very small ignition equipment, work which was embarked upon simply because of the almost total lack of information. The practical results of this work are set out in an appendix extending to some 64 pages, and are worthy of the closest study by designers and students. The rest of the text is descriptive and, to some extent, historical; but it appears to fill a gap which has been allowed to exist too long in technical literature.

Milling in the Lathe, by Edgar T. Westbury. (London: Percival Marshall & Co. Ltd.) 152 pages, size 4½ in. by 7 in. Price 3s. 6d. net.

Practically every mechanic whose workshop equipment consists of a lathe, drilling-machine, grinder and little else, experiences the necessity of rigging up some kind of contrivance which will enable him to undertake a milling operation in the lathe. The operation, however, is one for which no definitely set piece of apparatus which will cover all requirements is available, and the variety of different methods that have been devised for the purpose probably border on the infinite. This book deals in a thoroughly practical manner with the fundamentals of the subjects, describes many types of milling cutters, puts forward a large number of helpful suggestions for milling attachments and deals very fully with the practical application of milling processes. With all this, it is extremely well illustrated by line and half-tone, and should prove to be a veritable *vade-mecum* in many a small workshop.

Practical Armature Winding, by A. H. Avery. (London: Percival Marshall & Co. Ltd.) 100 pages, size 4½ in. by 7 in. Price 3s. 6d. net.

Perhaps, more than in any other process encountered in the amateur's workshop, that of winding, or re-winding the armatures of small motors is one that demands a very thorough knowledge not only of what to do but how to do it. No slipshod or makeshift methods should be employed if successful and permanent results are required, and in this book will be found all the essential practical information which the home, and many a professional worker should have. The general principles and theory of windings, connection diagrams, types of windings, insulation, doping and baking-out are dealt with in ten useful chapters, each of which is copiously illustrated in a manner that makes the subject easily understood. A compact and useful "Armature Winder's Reference Table" printed on a folding insert is included. The book is one that should be kept readily available by all electrical workers for information and instruction.

The B.C.A.S. Handbook of Pneumatic Equipment. Compiled and Published by the British Compressed Air Society. Price 20s., postage 6d.

This well-illustrated and comprehensive book sets out in detail the many applications of compressed air in modern industry, also the various types of apparatus for producing and employing it. The various chapters describe air compressors of the low-pressure and high-pressure types, rotary compressors and blowers, vacuum pumps, spraying equipment, pneumatic rotary and percussive tools, vibrators, hoists, pumps, ejectors, aircraft equipment and accessories. It concludes with a section of manufacturers' announcements and other industrial data.

Editor's Correspondence

Planing Thin Boards

DEAR SIR,—I thank both Mr. Sweetman and Mr. Whittamore for their hints *re* planing thin boards; but as boarding of a threshing machine is different from cabinet making, or planking a boat, I still think the way I carried it out was as good as any.

Machines are boarded with tongued and grooved boards, generally with chamfered edges (not beaded edge), and it was to get these chamfers on the edges nicely that I had to put the boards, ½ in. thickness, in double layer, to stop the works from showing through, and add strength. This was done by putting the outside layer vertical (as in prototype) and the other layer inside horizontal; the two layers were joined together, first by glue, and then nailed with 3/32 in. brads. I used hundreds, and care had to be taken when doing this, to cut round nicely where cross-members joined the side frames.

I started off, as stated in my article, by trying to plane the boards after cutting, and got very near to Mr. Whittamore's idea. I put two brads in the board, at the back end and punching them down under the surface a little, the boards being laid on a piece of 4 in. × 2 in., which had been trued up. But somehow I could not get an even thickness; as it happened, I was using a Stanley smoothing plane and I can vouch for it cutting. I did not mention the chamfers in my article I admit, and these were even more difficult to put on than the planing. I found, however, that by cutting several pieces the width of my intended boards, and planing up to gauge, then planing each edge, and putting on chamfers before cutting with my saw bench, they came off exact thickness and nearly like planing, and as these sawn edges came together when put on, they really held the glue better.

Some machines are boarded diagonally to give extra bracing to the frames, I know; but this, I think, depends on the bracing used in the framework.

Whichever way it is applied to a model, I think the double skin method is advisable. Anyway, nothing has shifted, or come off, so far, and the machine certainly runs very sweetly. I only wish it would hum a little more.

Yours faithfully,

Taunton. T. G. BETTLES.

Small Locomotives

DEAR SIR,—The letter from Mr. Scott in your issue of April 8th is most interesting and indicates that we have a worthy competitor. May I, however, take this opportunity of correcting a mistake that arose obviously from the need to save space in THE MODEL ENGINEER account of our exhibition? The claim we made was actually that we showed the smallest working model *Pacific*—a claim that Mr. Scott seems to disprove. As a matter of interest I give the following dimensions of our Mr. Charlton's beautiful locomotive: Length of engine, $3\frac{9}{16}$ in.; length of engine and tender, $5\frac{5}{8}$ in.; height $1\frac{1}{8}$ in.; dia. of driving wheels, 17/32 in.; dia. of bogie wheels, ¼ in. This locomotive has, to date, run no less than 10,000 scale miles and has earned £125 for charity. The wheels have been re-treaded once and the motor brushes replaced twice.

How is this for the smallest working model *locomotive*? A L.N.E.R. G5 tank No. 2081 with the following dimensions: Length, $2\frac{9}{16}$ in.; height to cab top, ⅞ in.; dia. of driving wheels 13/32 in. with 16 spokes; dia. of bogie wheels ¼ in. with ten spokes; dia. of armature ⅜ in.; dia. of commutator 7/32 in. So far this engine has run over 1,500 scale miles.

Both these are to a scale of 2 mm. to the foot.

Yours faithfully,

Newcastle-upon-Tyne. E. le. L. LAMB.

A "Double" Repulsion Motor

DEAR SIR,—Referring to Mr. Godfrey's article on the subject of "Repulsion" motors, may I be allowed to make a few observations that I think will clear up the mystery of the performance of his motor. The fact that the motor stopped suddenly when the current was switched off was due to the fact that the high tension winding had been chosen in the original test as a repulsion motor. The output from this winding acting as a generator would be sufficient to create the effect of a rapid brake due to the fact that there was evidently sufficient residual magnetism in the field system. Had the experiment been tried with the low tension winding shorted, this effect would not have taken place due to the comparatively small number of turns under the influence of this field. The fact that the high tension winding was chosen for shorting accounts for the very small power output, this was because the winding was incapable of carrying the current necessary to produce any useful work, this is illustrated by the trial of the low tension winding under the same conditions, practically all the power is now being developed by this winding, the output from the still connected h.p. winding is really not adding a great amount to the output.

In the article, Mr. Godfrey refers to the set-up as a repulsion induction motor; the motor is not performing as such, it is a simple repulsion motor.

A repulsion induction motor is a combination of the simple induction motor and the repulsion motor. A repulsion motor is a motor having a good starting torque, whereas the induction motor has not. To provide a motor that will have an exceptional torque with a reasonable current input we combine the two machines into one, as you might say. To do this we replace the usual squirrel cage rotor of the induction motor with a wound armature and commutator, the provision of this armature allows us to use the machine as a repulsion motor and give us a good starting torque. Having done this, we now, in a way, convert the armature into a so-called rotor by the simple process of short-circuiting the armature winding, the resistance of which under

these conditions is sufficient to give us the running requirements, that is, a machine of constant speed. In operation the motor functions as follows :—On starting, the brushes are short-circuited and the current fed to the stator winding, the machine now runs up to speed as a repulsion motor, we now short-circuit all the commutator bars and remove the brushes from the commutator and the motor continues to run as a simple induction motor. In practice, and to save brush wear, the commutator is usually hollow and they are made to leave the commutator after a certain speed is reached, at this instant an expanding sleeve makes contact with the commutator bars on the inside, thereby shorting them ; on stopping, everything returns to normal.

In making these remarks it is my intention to endeavour to assist your contributor in a little problem that may not be quite clear to him with this style of motor.

Yours faithfully,

Enfield. J. W. COOPER

Club Announcements

West London Model Power Boat Club

The next club event, which is a steering competition, is to be held at the Round Pond, Kensington Gardens, on May 30th, at 10 a.m., and it is hoped that all members will attend with their boats.

Hon. Secretary: G. E. FIDLER, 174, Oxford Gardens, N. Kensington, W.10.

The Oldham Society of Model Engineers

This society has been quite busy in the past few weeks, with a dinner and social which proved a great success, due in great part to Mr. Harper, chairman of the Northern Association of Model Engineers, and his film show given after dinner. A visit to a gasworks and a power station, along with trips to Heaton Park to join Altrincham Society in their lakeside meetings. All in addition, of course, to our usual fortnightly club meetings.

Future meetings :—

June 11th. R. G. Fielding speaking on "Cathode Tubes."

June 25th. Film show by Carborundum Company on "The Romance of Carborundum."

July 9th. 10-minute lecturettes.

All the above meetings on Friday evenings, 7.30 p.m., at King Street Co-operative Buildings, Room No. 3. Any visitors are welcome at these informal get-togethers.

Hon. Secretary: F. MILLER, 25, Eric Street, Oldham, Lancs.

Altrincham Model Power Boat and Car Club

The above club has now resumed regular running on the N.A.M.E. water in Heaton Park, Manchester, and good speeds have been recorded by both 15-c.c. and 30-c.c. hydroplanes.

These meetings have been well attended by visitors from neighbouring clubs, notably from Oldham and Rochdale.

The car section has been running fortnightly on a track at Ringway, and Mr. Tomkinson has exceeded 80 m.p.h. with a 10-c.c. car that certainly "speaks" for itself, as it were. Another member running a "Hornet Teardrop" has been lapping even faster, but no official figures are available at the moment.

Our annual M.P.B.A. regatta will be held on Sunday, June 13th, 1948, at 2 p.m., the venue being Heaton Park, Manchester.

Members of clubs and visitors are cordially invited to join us at this regatta, and all other events organised by the club. The secretary would be obliged if intending visitors and competitors would notify him prior to the event.

Would secretaries of clubs and others interested please note change of secretary, Mr. Bates having resigned. Any further information regarding the club's activities will be given gladly by the Hon Secretary, D. INNES, 122, Downham Crescent, Prestwich, Lancs.

Eltham and District Locomotive Society

The next meeting will be held at 7.30 p.m. on Thursday, June 3rd at the "Beehive Hotel," Eltham, when Mr. Hutton will again give one of his technical talks. At the last meeting Mr. Bucknole, the locomotive driver, gave a lecture concerning locomotive experiences, which was greatly appreciated by the society, and on this occasion there was an exceptionally good attendance of members, and one visitor who was subsequently enrolled as a member.

Hon. Secretary: F. H. BRADFORD, 19, South Park Crescent, Catford, S.E.6.

Brighton and District Society of Model and Experimental Engineers

For some time past it has been evident that the Church Street room has not been large enough, many members having to stand at meetings. The committee rightly decided that such a state of affairs was not good enough for the premier model engineering society in Sussex, so have secured the use of a larger and more pleasant hall. Our next meeting therefore, will be held at this venue which is the Presbyterian Hall, North Road, Brighton (immediately at the rear of Churchill House). The time is the same, i.e., 7.30 p.m.

Now we are a real live society, the committee see no reason to suspend meetings throughout the summer. They have, therefore, got together the following programme :—

Monday, May 31st. The winner of our Open Competition in the show recently, Mr. A. F. Winter, will describe the "Making of his Pioneer Generating Set."

Monday, June 14th. Mr. G. Clasby will talk on "Lifts, Elevators, etc."

Monday, June 28th. Mr. D. Eames will describe how to "Bind your 'M.E.'s'."

Monday, July 12th. Mr. Rowell, who at the moment of writing is the holder of the Sussex Cup, will be talking on his "4-8-0- 'O' gauge coal-fired Locomotive."

Hon. Secretary: H. G. ACHARD, 48, Aldrington Avenue, Hove,4.

Radio Controlled Models Society

In view of the country-wide popularity and interest in the Radio Controlled Models Society, the London area of the society was formed at a meeting in London on April 11th 1948.

The London area will hold a meeting monthly, generally on the second Sunday. The first meeting was held on May 9th. All interested should write to the Hon. Secretary and Treasurer, London Area, LIEUT. G. C. CHAPMAN, R.N., Pine Corner, Firwood Rise, Heathfield, Sussex.

The Junior Institution of Engineers

Midland Section. Wednesday, June 2nd, at 6.30 p.m. James Watt Institute, York House, Great Charles Street, Birmingham. Ordinary Meeting. Paper, "A New Approach to Band Conveyors," by O. J. B. Orwin (Member).

NOTICES

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The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. **All such correspondence should be addressed to the Editor (and not to individuals)** at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to THE SALES MANAGER, Percival Marshall & Co. Ltd., 23, Great Queen Street, London, W.C.2.

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